Welding Engineer

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APRIL, 1956

Construction weldors choose Jackson Electrode Holders. Model AW-C with high-copper alloy tongs and fiber glass insulation withstands severe impact, high temperatures. Jackson fiber glass Welding Helmet with new plastic insulated lens holder, combined with Jackson Safety Cap, provides durable, comfortable protection.

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SAFETY HATS and CAPS

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Write for Bulletin No. 45

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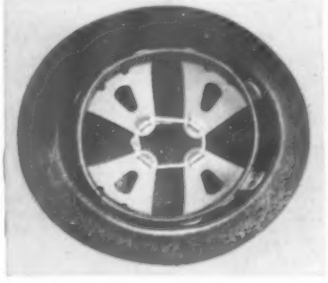

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Lowers Welding Costs!

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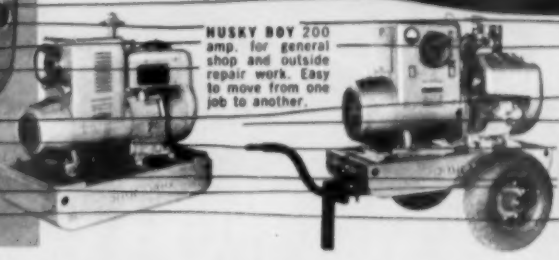
...on your jobs!

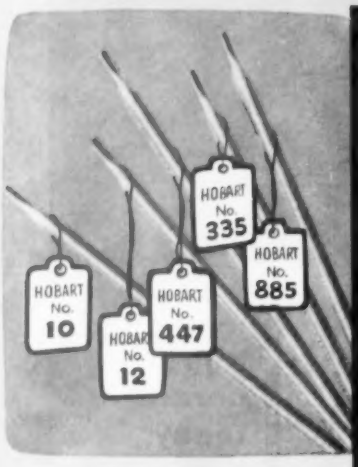


HUSKY BOY 200 amp. for general shop and outside repair work. Easy to move from one job to another.

AC POWER–AC WELDER 200 amp. for general service welding or power for operating drills, lights, grinders, motors, pumps, etc.

You'll like the new advantages you get with

HOBART air-cooled welders



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ELECTRODES

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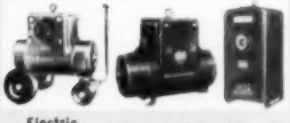
- faster metal deposit
- lower spatter loss

"CONTRACTOR'S SPECIAL"—a 250 amp. Gas Drive model that's light and compact, yet has plenty of engine power and a hot, fast, dependable arc.



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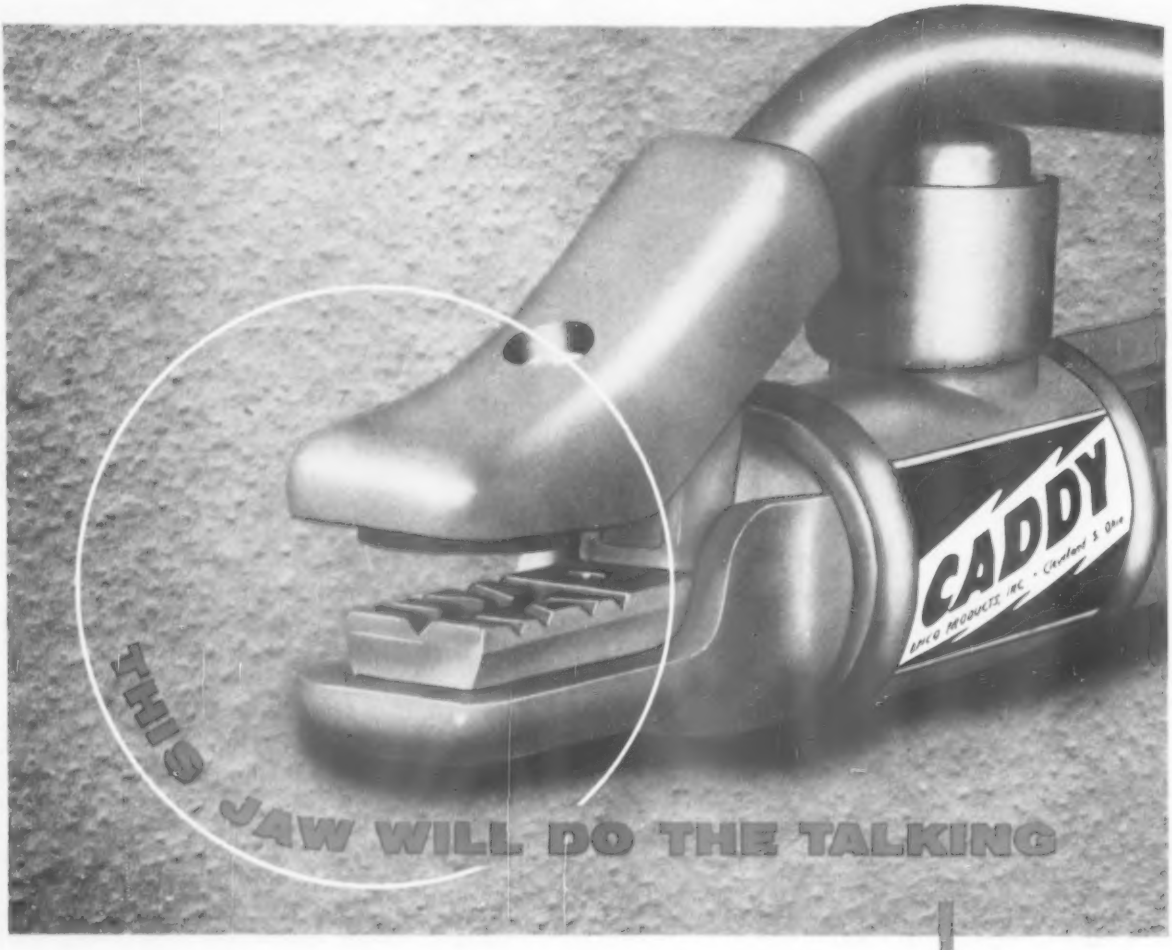

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Welding Engineer

APRIL, 1956
VOL. 41—No. 4

THE MAGAZINE OF JOINING
AND SEVERING OF MATERIALS

America's pioneer publication which, combined with The Acetylene Journal, has been devoted to the interest of the welding and allied industries since 1898

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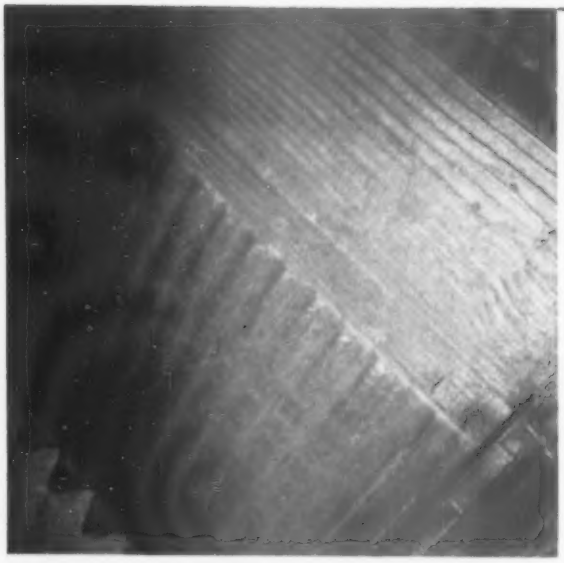

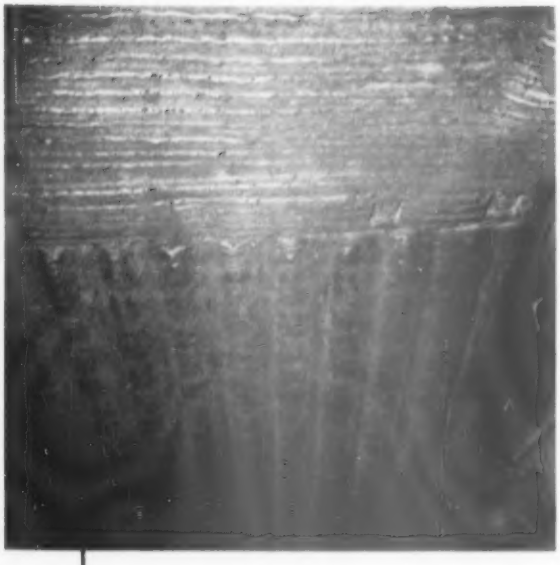

how to EXTEND working life of jaw crushers

apply VICTOR HARDFACING

No Disassembly This jaw crusher was hardfaced with jaws bolted in place, using 3/16" coated Tube Victorite. Despite cramped working area only 12" deep and 36" wide, high deposition rate and low spatter loss enabled welder to get uniform, non-sagging, long-wearing bead without distorting jaw.

Downtime Saver Because it goes on fast, without flux interference, and sets up quickly, coated Tube Victorite is wonderful for hardfacing on the job without disassembly of equipment.

Where To Use Coated Tube Victorite is a high alloy content rod with Rockwell C hardness of 55-58. It was developed specifically for tools subject to severe abrasion and impact, such as:

- Ripper Teeth
- Pug Mill Augers
- Jaw Crushers
- Roll Crushers
- Die Rings
- Tool Joints
- Scraper Blades
- Asphalt Mixer Paddle Shanks
- Mill Hammers
- Bucket Lips

It welds easily to carbon alloy and manganese steels—the latter frequently is used for buildup before applying coated Tube Victorite. It can be used for position welding. Deposit is smooth, even, free of pin holes. Made for AC and DC (reverse polarity) application.

Free Help—Victor hardfacing manual shows you the right rod to use and how to apply it. Ask your Victor dealer for manual and descriptive leaflets on Tube Victorite and other Victor rods . . . or write us.

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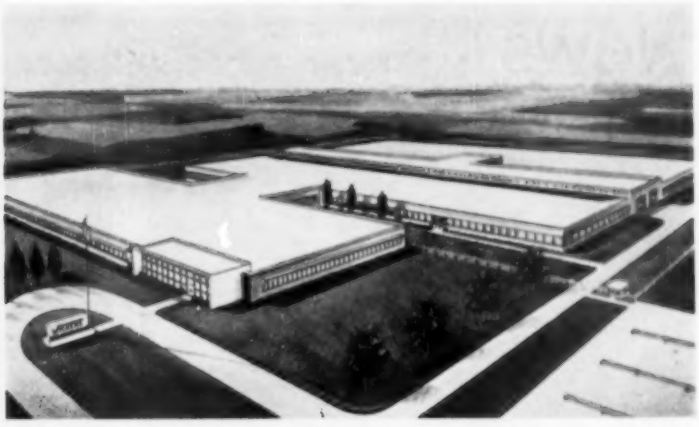
VICTOR for hardfacing

VICTOR EQUIPMENT COMPANY

ALLOY ROD & METAL DIVISION

Los Angeles 59, California • Wakita, Oklahoma

WELDING steel pipes together to form grid for new Indiana toll road. Pipes are are welded to prevent buckling. (See story below.)



SUBURBAN Detroit center provides greatly augmented research, engineering facilities. (See story below.)

News

Indiana toll road will melt snow, ice

Motorists entering and leaving toll plazas on a new Indiana toll road will meet with neither ice nor snow to stay their drive. The road is said to be the first to have snow-melting and de-icing units at all stop-start and pay areas. These units will be installed in the twelve plazas of the road which stretches across the breadth of the state.

To melt the snow, a series of steel pipe coils (to heat the pavement) will be buried 4 in. beneath the pavement surface. Boilers located under the toll plazas will supply heat to keep surface pavement temperature above freezing.

The steel pipe coils which form the "radiator" must be bent to shape for the grid. The pipes are welded by an electric arc instead of acetylene process because the instantaneous electric arcs prevent buckling of the pipes due to excessive heat.

—*U. S. Steel Corp.*

Automatic plant produces nitrous oxide

Production of nitrous oxide has begun at a new, completely modern plant of the Coyne Chemical Co., Memphis. All automatic controls allow operation by one man per shift. Geared to manufacture high pure nitrous oxide, the new facility will serve southeastern and southwestern United States.

Coyne Chemical Co. is located at 155 West Bodley Ave., Memphis. Officers of the company are John P. Coyne, president, L. W. Fleischer, vice-president, M. F. Coyne, secretary and treasurer.

Foote Mineral purchases Electro Manganese

Foote Mineral Co., Philadelphia, has assumed control of Electro Manganese Corp., Knoxville, Tenn. Final approval of the merger was to be granted at a special stockholders meeting.

Electro Manganese will continue as a division of Foote Mineral. No change in personnel is immediately contemplated.

Lindberg Industrial buys Jet Combustion

Lindberg Industrial Corp., Chicago, has purchased assets of Jet Combustion Co. in that city. Jet Combustion Co., organized in 1941 by the late J. E. Tegarden, specializes in manufacturing rotary forge furnaces and other large steel mill heating equipment. Operations of both firms will be merged at the Lindberg plant in Chicago.

Vickers Inc. in new center

Vickers Inc. recently occupied its new administrative and engineering center in suburban Detroit. The 150,000-sq-ft facility is devoted to research, development, engineering, sales and administration.

Included in the new center are executive offices; technical activities occupy the major portion of total floor space. All other departments remain at the home plant at 1400 Oakman Blvd., Detroit.

Discuss value of atoms in business

Value of nuclear research in their operations is the aim of a cooperative venture by 19 industrial firms. The firms are participators in such a program at Armour Research Foundation of Illinois Institute of Technology, Chicago. Among the companies is M. W. Kellogg Co., New York City.

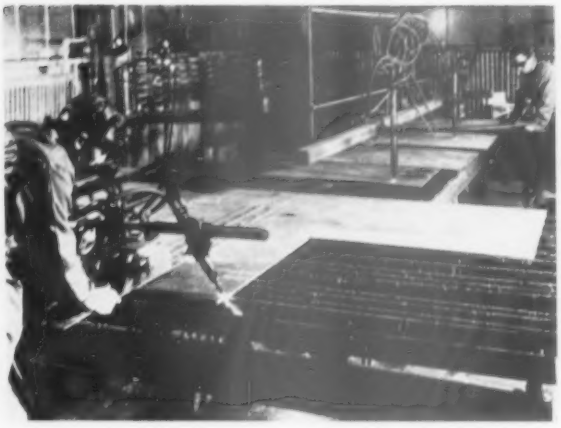
Buffalo distributor in new location

Rodgers Welding Supply, Buffalo, N. Y., distributor, has moved to 350 Masten Ave. in that city. The firm, formerly at Main and Ferry Sts., made the move in order to consolidate and expand its warehousing, office, salesroom and parking facilities.

Organized in 1940 and one of the pioneers in welding equipment supply in western New York, Rodgers Welding Supply is a distributor of a wide range of supplies, including gases and apparatus. Lee Rodgers, Sr., is the owner. His son, Lee, Jr., entered the business in 1949.

News

from page 5



WELDING research laboratory will investigate better techniques and design for welded construction. Facilities are available for fabrication and welding structures to 10 tons. Latest welding and allied equipment is provided such as the torch cutting machines shown here. (See story below.)

PRESENT at recent meeting of New Jersey Gas Dealers Association were, from left to right: (1st row) James Bluhm, Bob Flannery, S. C. Lum, Jr., E. A. Evoy, Thomas Carey; (2nd row) Charles Garrabrant, S. C. Lum, Pat Dougherty, Ed. Mueller, Frank D'Allessandro, Warner Geiger; (standing) John Varga, Joe Goodliffe, A. C. Axtell, Harold Stortz, James Cusick, Bill Hughes, Jr., Bill Hughes, Sr.

Worthington opens welding laboratory

Fully equipped for investigation of latest welding techniques is the welding research laboratory recently unveiled at Worthington Corp.'s Harrison, N. J., division.

The new facility will be used for welding application research, designing for welded construction and building of prototype models. The new laboratory is claimed to be one of the most complete research facilities of its kind.

The laboratory provides 5,000 sq ft of shop space. Researchers will have available latest welding machines and related metal working equipment. Facilities are provided for fabricating and welding structures up to 10 tons. The center will also serve for training programs in design and weld applications.

CGA elects new officers

At the annual meeting of the Compressed Gas Association, held in New York City, officers and members of the executive board were elected. A total of 41 members were elected to the board, including Canadian section chairman, J. H. Gibbs. Elected president was M. L. Griffin of Shell Chemical Corp.

Other officers elected were: James W. Dunham, first vice-president; A. R. Olson, second vice-president; Franklin R. Fetherston, secretary-treasurer.

On recommendation of a special committee, G. O. Carter was elected to honorary membership. Mr. Carter, formerly associated with Linde Air Products Co. and now retired, has taken an active part in CGA affairs for many years.

Union Carbide forms development company

Union Carbide Development Co. has been formed as a new division of Union Carbide & Carbon Corp., New York City. Long-term corporate planning and evaluation of new business opportunities will be important aims of the new company.

Operating divisions of Union Carbide will continue to carry on their own activities. Birny Mason, Jr., secretary of Union Carbide, has been appointed president of the new company.

Latest in welding at West Coast clinic

Latest developments in welding equipment and processes will await visitors to the first Santa Clara Valley Welding show and clinic, April 27 and 28. The event, said to be the first of its kind, will be held in the Engineering building of San Jose State College, San Jose, Calif. Co-sponsors of the event are the Santa Clara Valley section of the American Welding Society and the engineering department of San Jose State College.

M. W. Kellogg Co. in new building

Main offices of M. W. Kellogg Co., New York City, will be located in its new building in that city after April 29. The new structure at 711 Third Ave. will afford increased space for the firm.

Nuclear welding topic at AWS spring meeting

Technical sessions, latest welding processes and equipment, nuclear welding and research, discussion of safety, health and fire prevention will be among highlights of the annual spring meeting of the American Welding Society.

The meeting, to be held May 8-11, at the Hotel Statler, Buffalo, will run concurrently with the fourth welding show, May 9-11, and the second welding conference, both at the Memorial Auditorium.

Papers to be presented will range from reports on welding research to practical reviews of welding applications. A total of 21 sessions will be included at the AWS meeting. A feature of the opening meeting will be

(Continued on page 82)

The Bennett Pressure Breathing Unit—a complete hospital resuscitator and respirator—regulator by NATIONAL of California.

Continuously adequate respiration is vital to life and recovery — that is why various Bennett Pressure Breathing Units are equipped with regulators made by NATIONAL of California.

The Bennett Valve, originally designed for aviation high altitude research, is the heart of all Bennett Pressure Breathing Units. This valve is a unique flow-sensitive mechanism which permits the patient to actuate the unit in his own natural breathing pattern; or—to be resuscitated automatically if his breathing falters or stops. Various Bennett Pressure Breathing Units are manufactured by V. RAY BENNETT AND ASSOCIATES, INC.—because the very best and most dependable pressure regulators are vital in such life-sustaining units, this fine and experienced manufacturer has standardized on the dependable regulators made by NATIONAL of California.

The dependability, the long life and pressure accuracy of these regulators have made them the choice of the vast majority of all life-saving equipment manufacturers and these, also, are the soundest reasons why anyone employing cylinder gases in the welding industry will receive maximum satisfaction from these internationally known products.

National of ...california

We cordially invite you to write today — for free copy of a beautifully illustrated, 44 page brochure.

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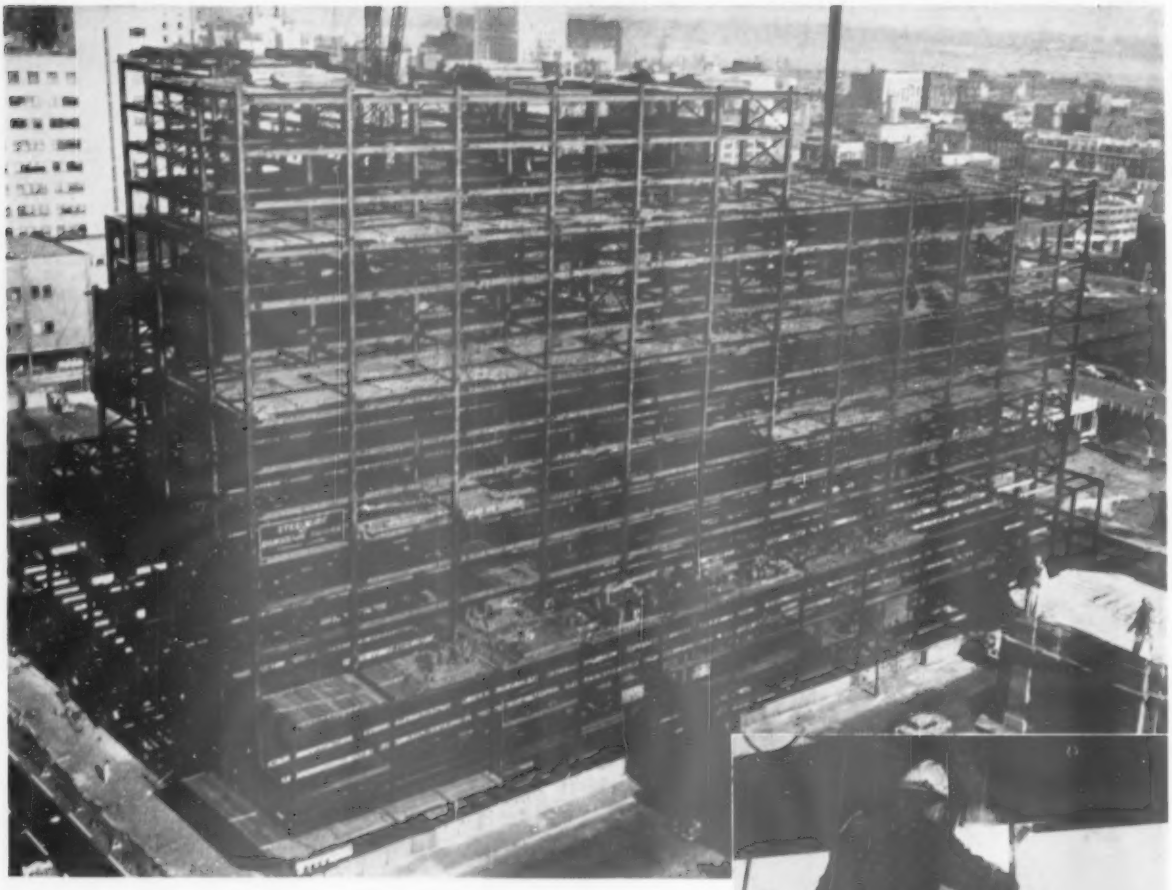
NATIONAL welding equipment company... 218 fremont street san francisco 5 california



Welded with ATOM•ARC 7016

Dominion Bridge Company of Canada is using Atom • Arc 7016 iron powder, low hydrogen electrodes* in welding the steelwork for this 21-story hotel. It's Canadian National Railway's new 20-million dollar Queen Elizabeth Hotel in Montreal.

Joining the lighter beams to the heavy columns without preheating called for low hydrogen electrodes. Atom • Arc 7016 electrodes in 5/32" diameters were adopted with the approval of both the weldors and Canadian National's inspectors. Along with the essential advantages of highest physical properties, x-ray quality weld metal and freedom from underbead cracking, Atom • Arc electrodes have a deposition rate much greater than standard 6010 electrodes. Starting porosity is eliminated and moisture pick-up is reduced.

Atom • Arc iron powder, low hydrogen electrodes have become standard on many structural and fabricated equipment welding operations. Find out why Atom • Arc is the first choice of users—write today for complete information. Alloy Rods Company, York 2, Pennsylvania.

High up in the steelwork where it's windy and exposed, welding can be a problem. But weldors are enthusiastic about Atom • Arc, not only for its speed but for its ease of operation in all positions and its materially reduced spatter.

VISIT OUR BOOTH #79
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Buffalo, N.Y.,
May 9-12, '56

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no finer electrodes made . . . anywhere

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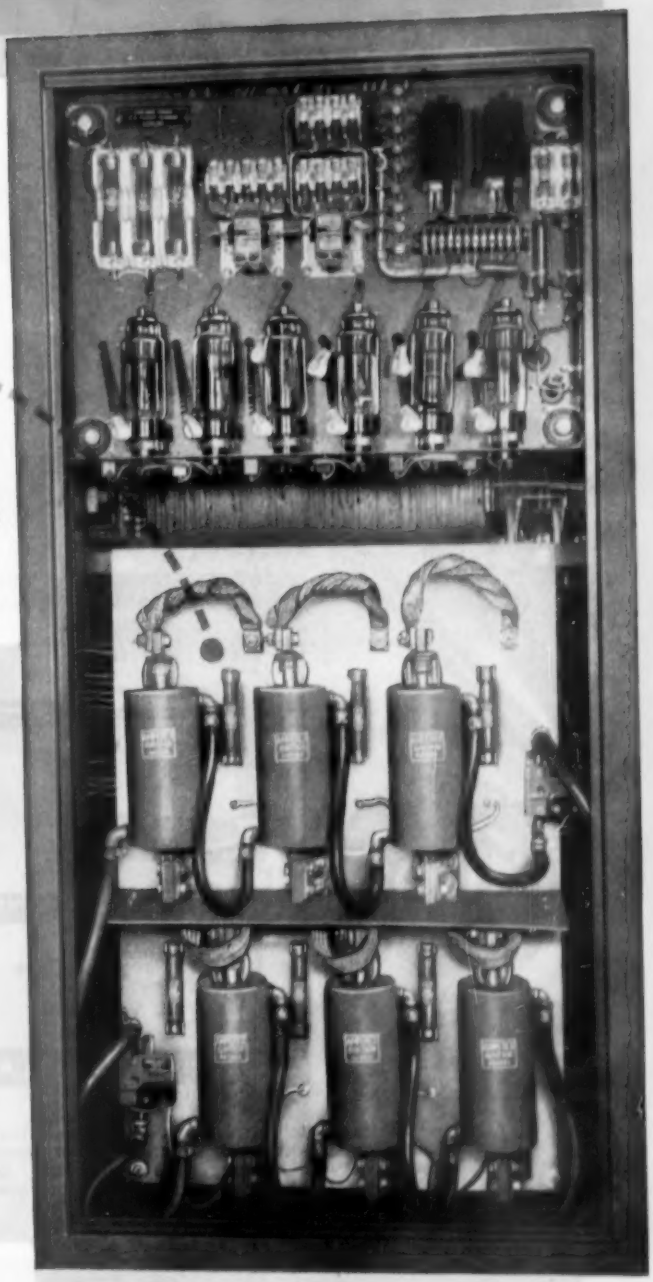
Amperex® IGNITRONS

used by Sciaky

Heavy-Duty, Three-Phase Welding Rectifier by Sciaky, equipped with Amperex AX5822 Ignitrons

Note convenient and compact installation of the Amperex Ignitrons on rectifier panel, made possible by the heavy, flexible anode leads.



Outstanding features of Amperex IGNITRONS:

- *exclusive "long-life ignitor"— promotes ease of firing and greatly extends length of service*
- *removable, heavy, braided, copper anode lead*
- *visible glass anode seal — simplifies observation of firing*
- *insulating shield around ignitor terminal*
- *rugged stainless and alloy steel construction*

Prove to yourself—
Amperex Ignitrons give lowest "per-hour-cost"

Also Available:
AMPEREX Thermostatically Controlled Ignitrons Types AX5551A, AX5552A and AX5553B
(No derating necessary for temperature-controlled types.)

Write direct to factory for data sheets and name of distributor nearest you.

Amperex ELECTRONIC CORP.
230 Duffy Avenue, Hicksville, Long Island, N. Y.
In Canada: Rogers Majestic Electronics Ltd.
11-19 Brentcliffe Road, Leaside (Toronto 17)

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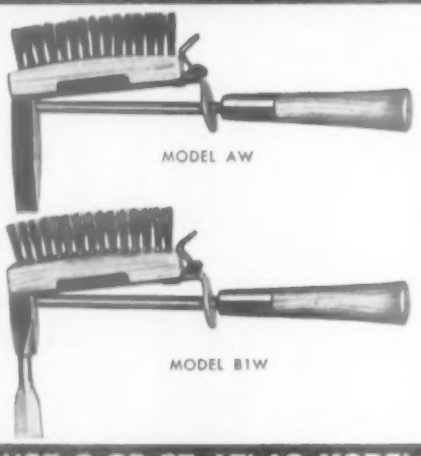
IT FITS THE HAND

Easier to Grip!

Safer!

FAMOUS ATLAS "DUAL TOOLS"



JUST 2 OF 27 ATLAS MODELS

PROVED PRACTICAL ATLAS WELDING ACCESSORIES

Ask your welding supply dealer to show you the complete Atlas line. Atlas "Tomahawks" and "Dual Tools" are constructed to outlast ordinary weld cleaning tools and actually cost less in the long run. Welders like their "feel" and balance, turn out more and better work with less fatigue.

ATLAS WELDING ACCESSORIES CO.

707 E. LEWISTON AVENUE, FERNDALE 20 (DETROIT) MICH.

Letters should be addressed to: The Editor, WELDING ENGINEER, 12 E. Grand Ave., Chicago 11, Ill. No letter will be published unless signed, but your name will be withheld if requested.

Rural welding

Dear Sir:

I think WELDING ENGINEER is a very good magazine and I have received valuable information from its pages.

I enjoy acetylene and electric welding and I also enjoy figuring out how to do a job quickly and easily. Most of those doing welding out here, not including the welding shops in town, are farmers and ranchers. It would be very helpful to the average farmer or rancher if you would include a page or more devoted to ideas and pictures that he could use.

Marvin E. Rouse
O'Neill, Nebr.

Flame-cutting

Dear Sir:

The reading of the February issue of WELDING ENGINEER has been a rewarding experience. In particular, I refer to the article by Mr. Bland ("Comparative testing confirms oxypropane cutting value," p. 22) and to the welding clinic, both of which discuss oxpropane cutting.

In your November, 1954, issue my article, "New flames for torches," touched on the economies to be expected from fuels other than acetylene.

James A. Browning
Dartmouth College

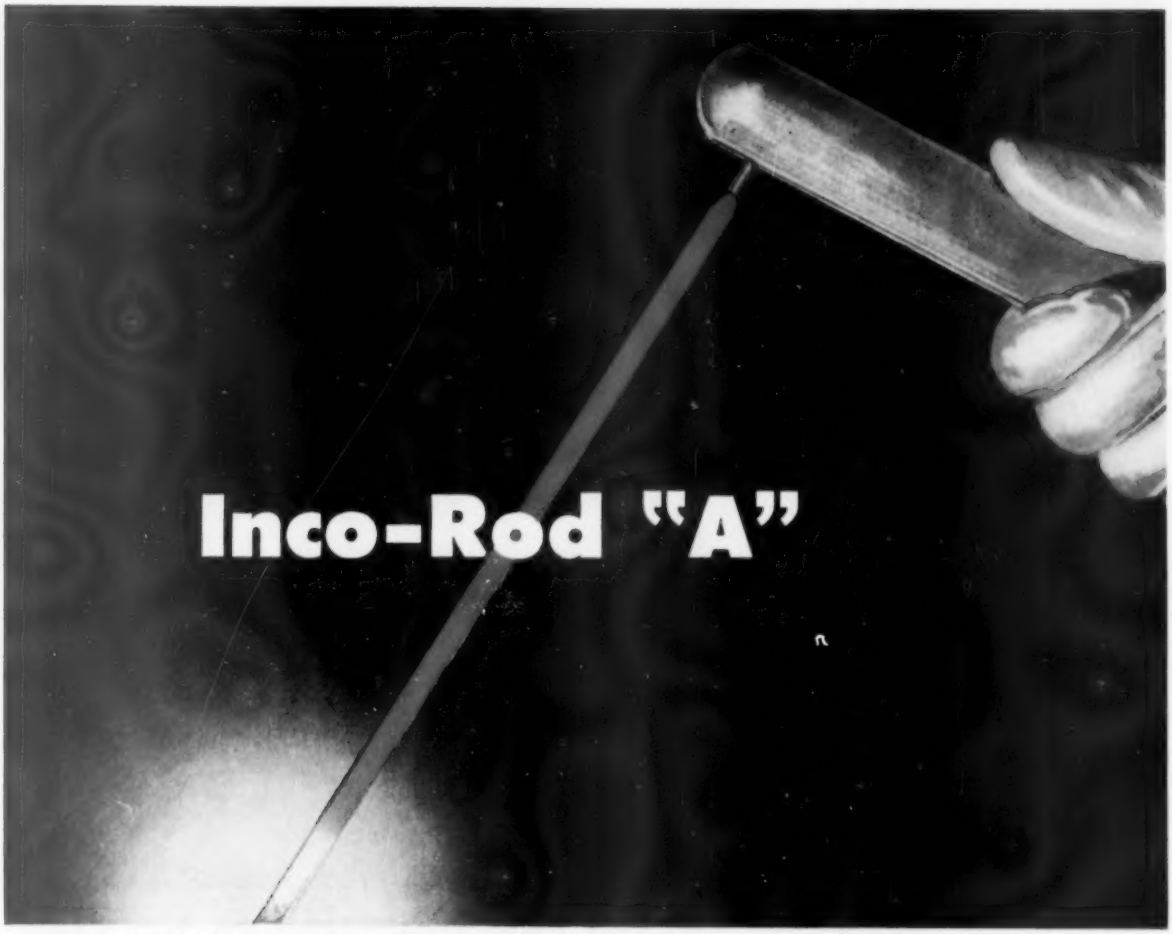
On-the-job tests

Dear Sir:

I liked the article "On-the-job tests for pipe weldors" in the February issue and would like to add something to the part about graduates of the "word-of-mouth" school.

I am on a job where there is no welding engineer. We use a rod that is not what the weldor thinks is the best, but have to use it. But this is what I do: I average 95% on all welds because of

(Continued on page 53)



INCO-ROD "A" electrode is new . . . different . . . unique!

. . . welds most dissimilar-alloy joints

This versatile, new electrode successfully welds mild steel to 330 . . . 405 to Inconel* nickel-chromium alloy . . . 304 to 410.

More than thirty such combinations have been made between and among ferritic and austenitic stainless steels, low-alloy steels, mild steels, high-nickel alloys, and other types of alloys.

In fact, we expect Inco-Rod "A"* electrode will prove satisfactory for more than 90% of such joints between dissimilar alloys.

This new easy-handling electrode with the distinctive *green* flux coating gives you strong, ductile, X-ray-quality welds. Gives you excellent operability in any position . . . spray-type arc . . . good slag removal! In addition, the impact properties at sub-zero temperatures, stress-rupture properties at elevated temperatures and corrosion resistance will be of a high order.

For welding data on many *proven* combinations of dissimilar alloys, write for the new Inco folder, 'Announcing INCO-ROD "A" '. Be sure to ask, too, about alloys you need to join. New information, constantly coming in from the field, may provide a practical answer to your welding problem.

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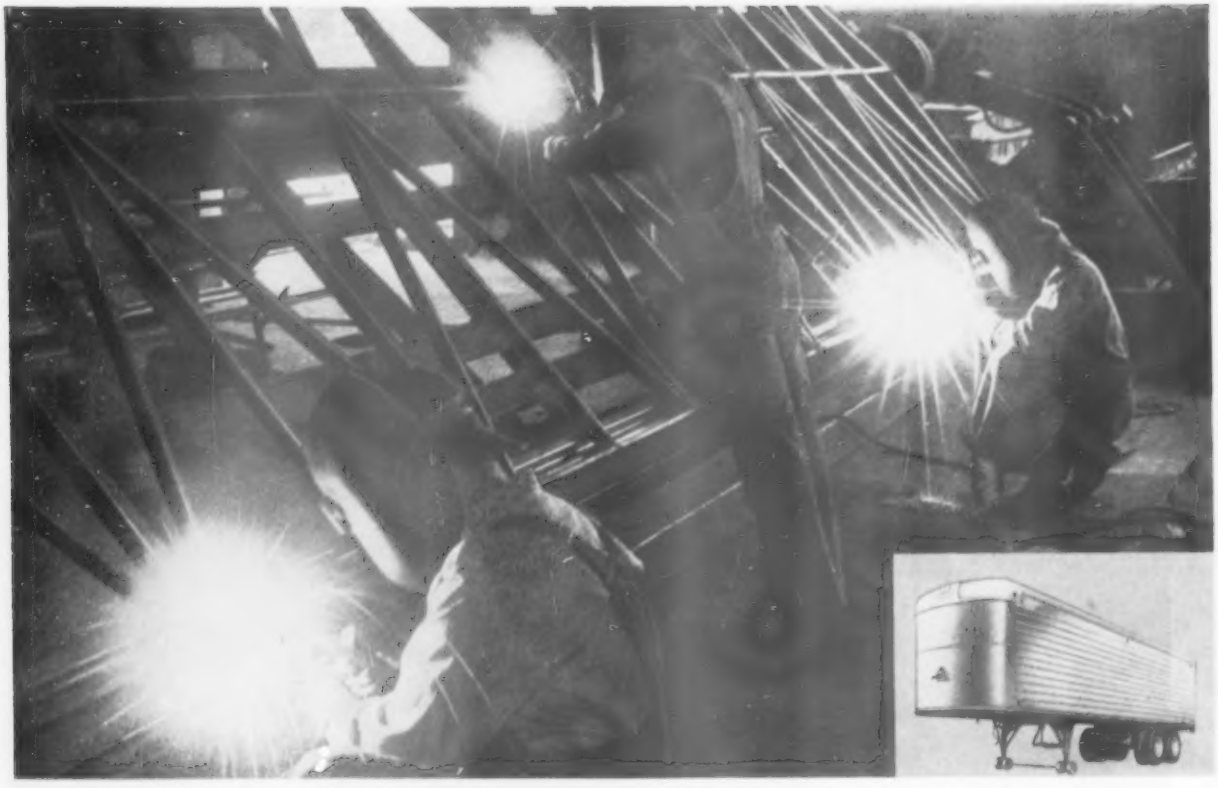
WELDING SHOW

Four handy sizes. INCO-ROD "A" is produced in 14-inch lengths, 4 diameters: 3/32-, 1/8-, 5/32-, 3/16-inch. Packed in 5-lb., tubular, asphalt-lined, protective containers (NEMA color coded).

INCO **Welding Products** • electrodes, wires, fluxes



The Champion is a feather-weight van built for heavy-duty service. For extra strength Airco welding rods, Easyarc 12 and Airco 387 electrodes are used *exclusively* to join the tough-but-light tubular steel frame. Faster, more economical production was also achieved through the use of Airco Heliwelding equipment, cutting torches and accessories.

4 Airco products help put new champion on the road —lighter by one thousand pounds!

The Dorsey Trailer Company, Elba, Alabama, wanted to cut the weight of its vans by a thousand pounds — without cutting durability or strength. An aluminum and tubular steel design solved the first part of the problem. The selection of Airco products for the all-important welding job neatly took care of the rest.

From planning to production you can rely on assistance — and completely unbiased recommendations — from Airco Technical men. For Airco is the leading supplier-manufacturer of all kinds and every type of welding and flame cutting processes, their controls, supplies and accessories. Write to Airco for free literature describing Heliwelding equipment and Airco electrodes.

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STRAIGHT WHEEL in Norton B11 resinoid bond makes short work of smoothing a heavy weld. Abrasive is ALUNDUM* aluminum oxide — tough and strong.

FLARING CUP WHEEL in Norton B11 resinoid bond employs a rotating guard. This, together with the B11's better balance, means easier, safer grinding.

DOUBLE PROTECTION. The improved pronged-anchor threaded steel bushing which is molded into the back of Norton cup wheels, shown with the revolving cup guard. Both serve to hold pieces together in case of accidental wheel breaking.

CONE WHEEL in Norton B11 resinoid bond is easier to use in a hard-to-reach spot such as this fabricated machine base. Result is faster, more profitable grinding.

One sure way to faster, better weld grinding

Norton B-11 resinoid bonded wheels are perfectly balanced to bring important **"TOUCH of GOLD"** *advantages . . .*

Perfect balance is one good reason why Norton B11 resinoid bonded wheels are best for your heavier weld grinding jobs. They "hug that work" closer, with least possible vibration and bounce.

B11 wheels have been thoroughly job-tested. They speed the work because they cut cool, cut fast and reduce operator fatigue. And improved processing methods assure uniformity from one wheel to another.

The result is much better weld grinding at much less cost.

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for details on the new B11 resinoid bonded wheels. Or write to us direct. And remember, only Norton offers you such long experience in both grinding machines and wheels to help you produce more at lower cost. NORTON COMPANY, Worcester 6, Mass. Distributors in all industrial areas, listed under "Grinding Wheels" in your phone book, yellow pages. Behr-Manning, Troy, N. Y., division of Norton Company.

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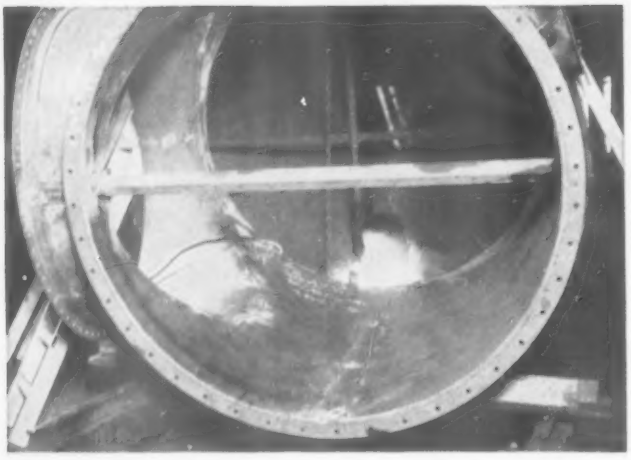

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iron-powder electrode for mild steel with AC or DC

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- higher deposition rate . . . 10% to 30% faster arc speed
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APRIL, 1956

Welding Engineer

ESTABLISHED 1916

Teach 'em to weld

PRICE INCREASES, under almost any circumstances, are not good news. But the recent increase in price of welding electrodes certainly should be good news for everyone with a sincere interest in welding.

Unless some manufacturers or distributors feel the new prices give them a wider margin for price-cutting, there *should* be more funds available for research. And we feel strongly that most users want this research and the improved, all-purpose electrodes that will surely result. Electrode prices, after all, have never been a major factor in the use of welding.

Additional funds for research may possibly help to clear up the confusion that exists in the area of electrode classification. A prime example of the misguided ambition affecting some electrode manufacturers are three arc welding electrodes all bearing an AWS E6013 designation. Welding will never prosper so long as complications like this continually arise.

Perhaps the most advantageous, long-range use of surplus funds created by the price rise, however, will be the excellent opportunity to create more and better welding engineers and technicians. These men have always been in short supply, and colleges, without the aid and encouragement of the welding industry, will never correct this unfortunate situation.

THE NUMBER of engineering schools that have cut shop courses from their curricula keeps growing and, of those that still offer lessons in practical applications, few have adequate shops. Most of the equipment is old and worn and there is usually not enough of it to go around. Logically, the only way to beat this situation—if your interest in welding is anything more than academic—is to arouse *wide, vocal* support for the classroom and shop training of more welding engineers and technicians.

Colleges and engineering schools are making a studied attempt to broaden the engineering student's background with liberal arts courses. This is a very good thing, but it means that the engineer-to-be spends about 15% more time in class than other undergraduate students. To crowd this technical and non-technical training into a four-year schedule, the schools are classing shop courses as expendable.

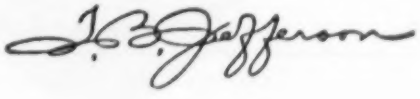
WHAT *is more important—a four-year graduate who doesn't know a lathe from a welding machine, or a five-year grad who can easily find his way around a shop?* Let's have five-year graduates who will join industry with a practical background, and be better engineers for it!

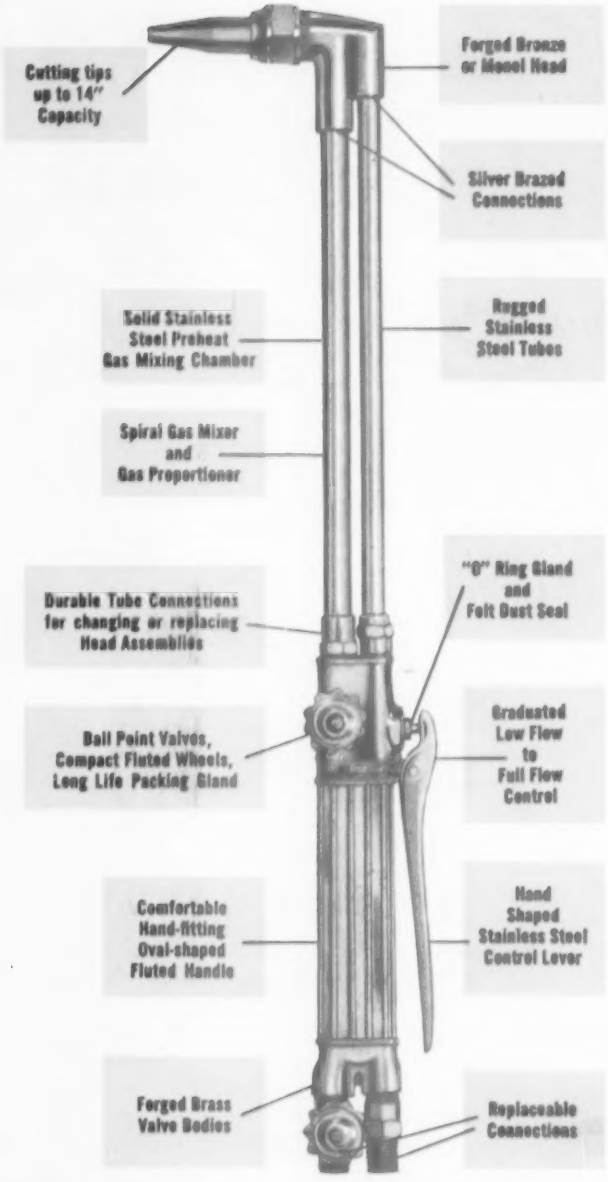
We all know there is little real welding engineering knowledge in most shops. Foremen usually are long on practical experience and short on technical or scientific training. Mechanical or electrical engineers without formal training in welding make up the engineering department.

Even in the best of shops there is friction between weldors and engineers. Respect will replace friction when a welding engineer with practical knowledge enters the shop. If this engineer can lay a good weld bead, respect becomes admiration.

There will have to be more colleges granting the degree of welding engineer. The man who has specialized in welding—who has learned and worked with various processes at his desk and in a shop—will better understand the human element that plays such a big part in welding. He will also create welding designs that are practical and economical.

More than good engineers are involved in any attempt to expand training and establish more welding engineering courses. All it takes is cooperation. We have a plan, and it will be presented on this page next month.

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Try this torch on your toughest cutting job . . . you'll find it keeps a cool head . . . time tested Victor spiral mixer and gas proportioner assures safe, economical operation.

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Choice of Monel (MO) or bronze (ST) heads . . . four control lever positions to suit every operator preference and job need. Four lengths: 21", 27", 36" and 48", available with 90°, 75°, 45° (ST Models only) or 180° angle heads.

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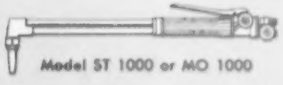
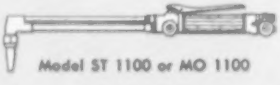

Model ST 1000 or MO 1000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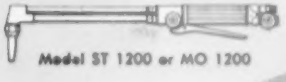
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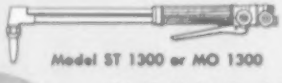
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29

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Mfrs. of welding & cutting equipment; hardfacing rods, blasting nozzles; cobalt & tungsten castings; straightline and shape cutting machines.

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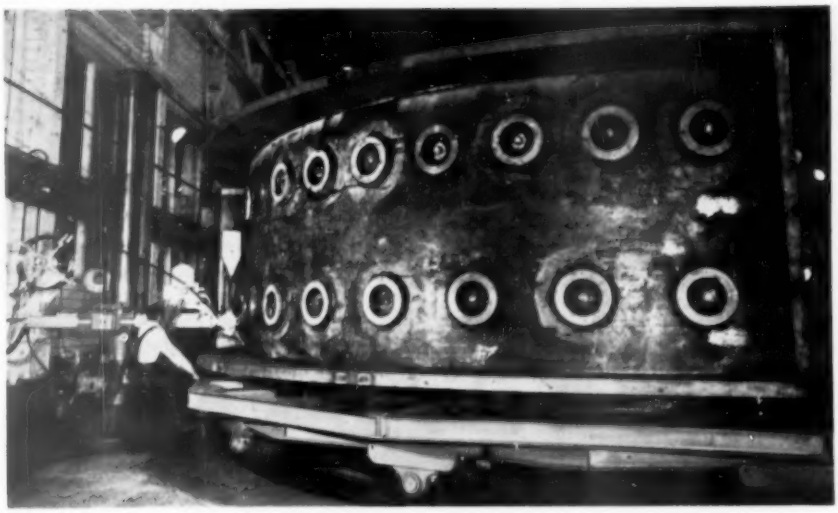


ONE of eight submerged-arc units at Sunnyvale plant welds compressor stator quadrant mounted on specially designed roller fixture.

Western firm's product diversity creates a need for welding variety

BY WALLACE J. ERICHSEN

THE SUNNYVALE, Calif., plant of Westinghouse Electric Co. manufactures a diversity of products ranging from the world's largest rotating machine—with five axial-flow wind tunnel compressors—to small home heaters. Electrical products include distribution and power transformers, panelboards, switchgear, circuit breakers and motors ranging in size from 1 to 6,000 hp.

Mechanical equipment includes ship propulsion and power plant turbines up to 105,000 kw, ship reduction gearing, condensers, feed water heaters, evaporators and other unfired pressure vessels. Sunnyvale also builds hydraulic equipment, such as butterfly and hollow jet valves used in large dams controlling water flow from the reservoir.

It is estimated that the value of fabricated products (as joined) is greater than 10% of net sales billed by Sunnyvale. During 1955, 200 tons of welding wire and flux were used. Thirty tons of this total were submerged-arc wire and 55 tons were submerged-arc flux.

A considerable quantity of brazing materials, including phosphorized copper, silver solders, fluxes and low melting solders are used each year.

All this indicates the importance of metal joining to the Sunnyvale operation, especially since most finished parts start as weldments and valuable machine time spent in finishing imperfect fabrications would be wasted money.

Processes and Equipment

Metal joining processes and equipment in production use at Sunnyvale include the following:

1—Manual arc welding process, using powdered iron, non-ferrous, chrome-molybdenum and stainless steel electrodes. Sunnyvale uses 125 a-c and d-c motor generator sets and d-c rectifier welding machines.

2—Oxyacetylene cutting, welding and hardfacing. The plant presently is evaluating propane as a substitute for acetylene for an estimated yearly savings of $10,000.

3—Semi-automatic equipment, comprising eight submerged-arc units, six of which operate on 750-amp a-c welders. Two units operate on 600-amp d-c rectifier welders.

4—Tig (tungsten inert-gas) welding is used on thin materials, for repair and for tool steel overlay work.

BOOM welder can travel to 22-ft height, rotate 360 deg and move in and out on 14-ft arm. Detachable platform allows operator to follow work closely.

5—Resistance methods include spot, seam and projection welding, particularly on transformers and switchgear products. There are five spot welders ranging in size from 30 to 400 kva, two projection welders of 450-kva size and one of 600-kva ca-

pacity. Two seam welders of 250 and 400-kva size are in regular use.

6—Brazing techniques used at Sunnyvale include torch, furnace, resistance, dip and incandescent carbon methods. Brazing materials most commonly used include BCuP-3, BAg-6, BAg-4, BAg-1 and an alloy of 50% silver, 15½% copper, 16½% zinc and 18% cadmium.

7—Sunnyvale also uses the stud welding process. Four stud welders are on the production line—two for transformer tanks and the others for compressor stator sections. Over 60,000 studs, varying in size from ¼ to ¾ in, were used in 1955.

8—Metal spray guns are used in steam turbine work and to apply corrosion and wear-resistant surfaces to hydraulic products. The plant maintenance department also rebuilds worn equipment parts by the metallizing method.

Radial Boom Welder

One piece of equipment designed especially for work at Sunnyvale is a boom welder similar in appearance to a radial drill press. This welder can rotate around its support column, and the head moves in and out so that linear as well as circumferential welds can be made. Contour or irregular seam welding can be done by means of a constant forward tension and a guide roller at the welding head.

An automatic submerged-arc welding head with two duplex 400/800-amp d-c rectifier machines, in parallel, are used to make double bevel T-joint and fillet reinforcement between 3½ in. circumferential flanges and 1¾ in. skin plate on compressor stator quadrants. The weld is made at a radius of 15 ft.

Approximately 26 passes are required in this application, using 500 to 700 amp at 28-38 volts reverse polarity at a speed of 14 to 22 in. per minute. A 3/16-in.-diameter welding wire is used for nearly all automatic welding.

The radial welding positioner was designed for the compressor job around standard components. Two power rolls with variable speed drive for rotating cylindrical vessels when making circumferential welds were adapted so that rubber-tired rollers would run on the steel plate floor. The 5-hp motor rotates weldments and fixtures weighing up to 75 tons at any desired welding speed.

Welding Organization

Although heavy and light fabrication shops are physically separated, Sunnyvale's welding activity is organized under one manufacturing superintendent, one general foreman and nine additional foremen as one integral operating unit.

The Manufacturing Engineering Dept. serves welding shops with eight manufacturing and industrial engineers and a welding consultant. This department developed ideas leading to the design of automatic welding equipment and positioners now used in manufacturing compressors.

Design Engineering works closely with weld shops and manufacturing engineering personnel on joint design and related problems. In this way, the process and equipment knowledge of shop people is used to fullest advantage by the designer.

Quality Control has five inspectors devoted to metal joining, or one inspector for every 35 workers engaged in fabrication. In addition to dimensional and visual inspection, considerable reliance is placed on magnetic particle inspection.

The Materials Testing Laboratory is in charge of radiographic work used on weldments and for casting repair. Sunnyvale has a 250-kv jib-type X-ray unit and four cobalt 60 radioactive sources ranging in strength from 250 to 1,150 millicuries. Ultrasonic testing equipment is also being acquired.

Weldor Qualification

Other laboratory quality control work deals with conducting welding qualification tests for operators, procedures and equipment. An applicant applying to the Industrial Relations Dept. is sent first to the foreman for an interview.

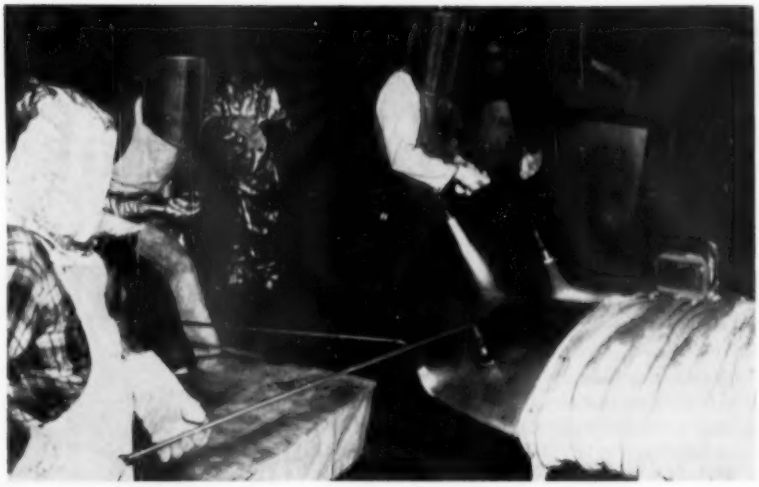
If the foreman is satisfied, the applicant—on his own time—welds one vertical and one overhead test plate in accordance with MIL-STD 248 (Ships). This is the new Navy qualification test No. 2 which is a single bevel butt joint in ¾-in.-thick plate.

The same day test plates are welded, they are X-rayed. In this way, the applicant knows by the next morning whether or not he has qualified. Using this procedure, operator qualification costs have been kept low.

If the applicant passes X-ray tests he is qualified at Sunnyvale for all welding (including Navy work) except ASME unfired pressure vessel fabrication. If the weldor is to work on pressure vessels, the X-rayed test plates are machined and bend tests are made.

ALUMINUM-bronze wear-resistant material is sprayed on 5-ft-diameter steel cylinder designed for 84-in. hollow jet needle valve. Metallizing process is also used for maintenance and to rebuild parts.

TYPE 403 stainless turbine reaction blades up to ¾ in. thickness are joined to carbon steel packing pieces by dip brazing in 70-30 brass alloy. Burner heating allows good temperature control.



HEAT-deflecting garments and masks protect torch operators as they fuse hardfacing alloy to propeller blade.

Another "ironclad" for the Navy

WEARING so-called "hot papa" suits and special headgear to protect themselves from intense heat, personnel of the U. S. Naval Engineering Experiment Station, Annapolis, Md., successfully hardfaced an 8,600-lb cast steel ship's propeller blade.

Rapid deterioration in service has seriously limited the useful life of these blades, and the Naval Experiment Station undertook the extensive hardfacing experiment in the hopes that they may have found a solution to this costly and troublesome problem.

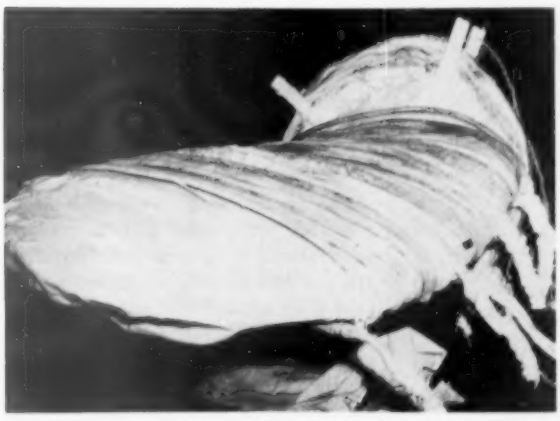
Before starting the hardfacing operation, the entire blade was preheated by low-frequency induction coils. Preheating served two purposes: it allowed heat input to the oxyacetylene torches to be absorbed almost entirely by the alloy overlay, thus speeding the job, and it prevented distortion of base metal as well.

Because of the intense heat (about 1,800 F) created by the use of many torches, a crew of 24 operators was constantly rotated. The induction heating swathing was removed, a section at a time, and a corrosion- and erosion-resistant alloy was sprayed over the surface of the propeller blade.

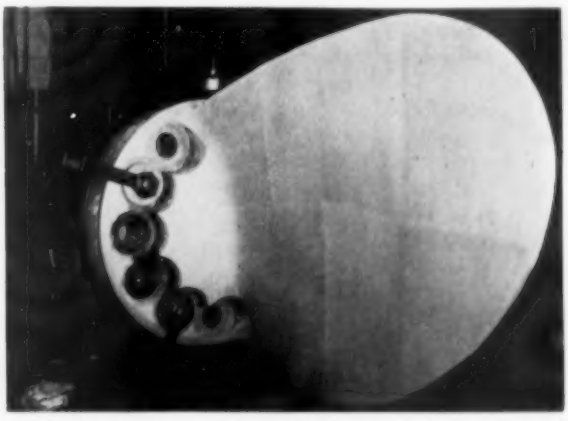
Six members of the heating crew immediately applied their long-handled, oxyacetylene heating torches to the blade, melting the hardfacing alloy and fusing it with the base metal.

The entire operation was carefully planned beforehand; each operator knew precisely what to do, and where and when to do it. No time lag was experienced, therefore, and the results were generally good. A few porous areas were found and repaired.

This largest of the Experiment Station's hardfacing projects will be inspected by engineers of the Navy's Bureau of Ships. Passing this inspection, the blade will be installed in an operating vessel for evaluation under actual service conditions.



LOW-frequency induction heating coils and swathing bring cast steel blade to proper preheat.



HARDFACED surface on blade is approximately 0.04 in. thick. Only a few porous areas were found.

In welding economically . . .

It's position that counts!

ANY device used to position weldments for more convenient fabrication is a welding positioner. To be more exact, however, a true welding positioner is specifically designed to tilt, revolve and elevate weldments quickly and safely for efficient downhand welding.

This year, $4,000,000 will be spent by the welding industry to purchase welding positioners. A manufacturer of positioners estimates an additional potential market of $8,000,000 in the United States.

Metal fabricating shops employing weldors are spending between $10,000 and $20,000 a year for each operator. The shop producing a repetitive item will be closer to the $10,000 mark. The custom engineering shop will bear expenditures closer to $20,000

The average figure for companies engaged in welding will fluctuate between $14,000 and $18,000 per weldor per year.

The individual dollars that go into this figure break down like this:

$.02—Power
.04—Machine (including maintenance and depreciation)
.03—Electrodes
.86—Labor and overhead

$1.00—Total

The only sizeable and sensible saving to be made on each welding dollar is in the $.86 paid out in labor and overhead. By applying proper positioning in the shop, estimated savings of 17 to 50% can be made on this $.86 labor and overhead factor.

Cutting Fabrication Costs

One of the most important advantages in using a good welding positioner is a reduction of fabrication costs over former methods. The average fillet weld, made with an all-position electrode when the weldment is not positioned, requires three passes. On a positioned weldment only one pass is required and a far better fillet is made.

HUGE weldment is taken in stride by this heavy-duty positioner, allowing economical downhand welding positions and eliminating unnecessary hoist operations.

By positioning the weldment for downhand welding, the weldor is able to use a downhand electrode that is hotter and larger. As a result, the weld is made faster and smoother and there is less spatter.

This ratio of saving increases directly in proportion to weldment size and complexity.

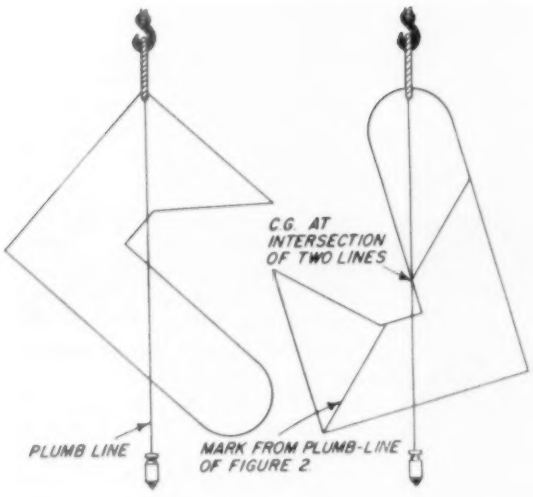
The speed at which a weldment can be maneuvered into different positions represents a considerable saving in lost arc time. A simple box-type assembly, to be produced from four separate pieces, will require a total of four fillet welds.

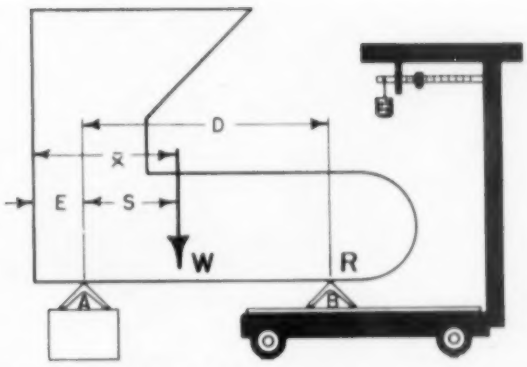
With a good positioner, the weldor simply mounts the assembly on the positioner table, secures it with clamps to T-slots in the table top, or locks it in a pre-established fixture which is already secured to the table top. With this single set-up, and with handy push-button control, the weldor can raise, lower, rotate or tilt the entire assembly to make his four welds in half the normal time.

Older, Costlier Method

Using the sling, hoist and bench method, the weldor had to arrange and attach a suitable hoisting sling to the tack-welded assembly, secure the sling to the hoist and elevate the assembly to bench height or other working position.

He then had to block the piece, disengage the sling and start to weld. This complete handling cycle had to be repeated three more times on this





LEFT: Suspension of a large weldment of irregular shape in two positions will accurately determine the center of gravity. ABOVE: Weighing of irregular weldment calls for knife-edge supports on both scale and ground. R (scale reading) x D, divided by W (total weight of workpiece) will give S, or distance from support A to center of gravity.

one unit to gain the advantages of downhand welding.

It is quite obvious that this method consumes a big portion of what would otherwise be productive arc time. An even greater loss in production results when positioning is done by hand, particularly if the weldor must rely on extra help to handle hoisting slings and to guide the assembly into position.

The size and capacity of a welding positioner is based on its load-carrying ability. Standard capacities range from 500 to 16,000 lb, although some heavy-duty models may have a rated capacity of 35,000 lb and more. These large positioners are mounted with the column set in the floor. Smaller models also can be mounted in this fashion, or they may be portable.

Center of Gravity

To employ the proper positioner for any production or maintenance usage, it is necessary to know the total weight of the weldment, including weld metal to be deposited; weight of fixture holding weldment, and the weldment's center of gravity.

Center of gravity may be determined by calculation, suspension or weighing, depending on the size and design of weldments. Relatively small weldments with a simple design, for instance, might safely be positioned on the basis of calculations alone.

Larger, heavier weldments with irregular shapes, however, will have to be weighed and/or suspended in at least two positions to determine the center of gravity.

Load ratings for those positioners with a 2,500-lb capacity are estimated on the basis of a load whose center of gravity is 6 in. from the table. Rated capacities for larger models are figured on a center of gravity 12 in. from the table.

Power Sources

Constant and variable-speed power drives, hydraulic systems and the manual method are used for positioner tilting and table rotation.

Intermittent operation of a constant-speed motor will vary the position of a weldment as it is rotated past the weldor. The variable-speed motor can be set to move the weldment at a predetermined, constant rate of speed, thus allowing the use of an automatic welder.

Welds that are made better, neater, faster and cheaper, with a minimum of operator fatigue, are practically assured through the use of welding positioners, no matter what their power source may be. The only limiting factor in the economical use of these devices is an operator's ingenuity—a quality that should be quickly developed with training and experience.

* * *

For the information and line drawings contained in this article, the editors of WELDING ENGINEER *wish to thank Harnischfeger Corp., Worthington Corp., The Pandjiris Weldment Co., Unique Turntable and Equipment Corp. and Cullen-Friestedt Co.*

VERTICAL welds like this, which take longer and cost more than the horizontal downhand method, can easily be eliminated through the selection of a proper welding positioner.

LEFT: A straddle truck brings 15 lengths of pipe to the welding shop in the yards of Humble refinery.

Maintenance and fabrication

A Texas refinery improves operations

By Jodie Isenhower
Equipment Engineer
Humble Oil and Refining Co.
Baytown, Texas

ACCORDING to a recent survey, the refining industry spent over half a billion dollars for maintenance during 1953. Approximately one-fifth of the total refining cost was spent on maintenance, and one out of every three refining employees was engaged in maintenance work.

These figures give some idea of the over-all magnitude of refining maintenance work and its importance to the refining industry.

The industry has always devoted much time and money to research and study of processing operations. However, until recently, the industry as a whole devoted a comparatively small amount of time and money to improving mechanical operations. The use of industrial equipment for field work was very limited and few refineries had adequate shop facilities.

This was particularly true of Humble Refinery at Baytown. At the end of World War II, Humble's mechanical operations were severely hampered by the lack of adequate facilities for mechanical work. The refinery had undergone a very great increase in size immediately preceding and during the war.

Undeveloped Maintenance

At the same time, little change had been made in maintenance facilities since the refinery was erected. Humble's management was aware of these deficiencies and as soon as conditions permitted, a program was inaugurated to improve facilities and maintenance operations in general.

At the beginning of the improvement program, each mechanical craft occupied a separate building. All of these buildings were not located in the same area and in some cases the distance between the crowded, poorly arranged and lighted shops was several thousand feet.

Except for the machine shop, shops were under-equipped and material handling and transportation equipment was inadequate. As a result, most of the work had to be performed in the field and productivity was low.

Welding facilities and operations, in particular, were poor. It was obvious that labor costs could be reduced and coordination of work between crafts improved if all crafts were housed in one building. Also, considerable manpower could be saved by performing more work in shops and less in the field.

To Improve Facilities

However, to realize this saving it was essential to improve material handling and transportation facilities in order to get equipment to and from the shop economically.

At the start of the program, use was made of built-in handling facilities on process units. Among these were monorails and gantry cranes, which normally were equipped with chain hoists for handling heavy loads. Where these facilities were not available, guy derricks, gin poles and other temporary riggings were used. The use of these built-in handling facilities was highly unsatisfactory.

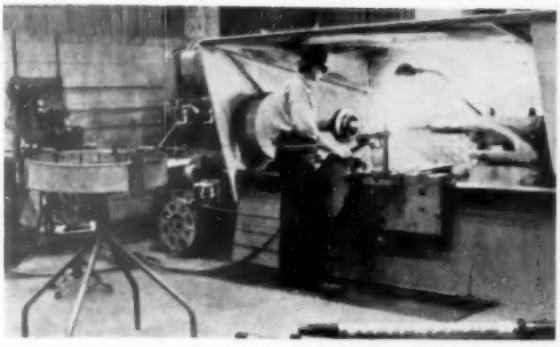
Smaller pieces of equipment were handled manually or with air hoists. Erection and removal of piping was usually manhandled, and large pipe gangs were the general rule. Transportation facilities consisted of flatbed trucks, tractor-trailer units and wagons.

During the past ten years, this situation has changed completely. At the present time, very little built-in handling facilities are being installed on new process units. Instead, new units are being laid out to permit effective use of mobile handling equipment.

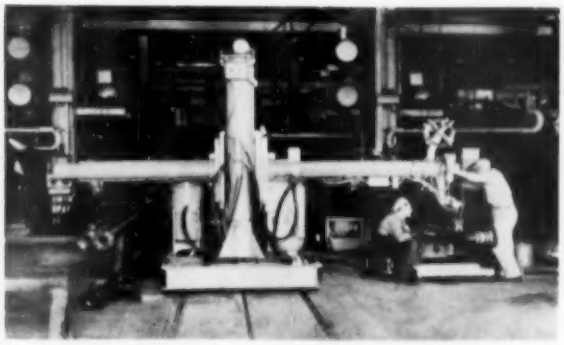
Welded Fabrication

In addition to its forward strides in the maintenance field, Humble has also taken steps to improve the welding and handling methods used in pipe fabrication.

This article is based on a paper presented before a meeting of the International Acetylene Association.



HARDFACING is important to maintenance. In one year, by hardfacing almost 500 shafts, pistons and other items, firm saved over $36,000.



SUBMERGED-arc welding equipment handles most of the pipe fabrication at Humble. Mounted on railroad tracks, this machine can run a distance of 72 ft.

Submerged-arc welding equipment is used in fabricating piping for the firm's two fluid catalyst cracking units. Several techniques have been used in fabricating this pipe. One popular method calls for a tractor-mounted welding machine which welds a bead on the inside of a pipe.

Seams are then flame or arc-air gouged and automatically welded from the outside. On piping where a back-up strip can be left in the pipe, outside welding alone is done.

Use of Tig

Piping fabrication work is divided into two sections: triple-jointing of straight pipe sections, and the fabrication of bends, off-sets and short sections of straight pipe.

The pipe used in the triple-jointing operation is delivered to the shop by straddle truck. Three sections of pipe are tacked together, flanges are installed and the first bead is welded manually. (Inert-gas shielded welding equipment with nonconsumable electrodes is used extensively in welding the first pass on certain types of alloy piping.) Special rolls move the pipe laterally on the rack for proper alignment.

The pipe is rolled onto turning rolls where the final weld is completed with submerged-arc equipment if the pipe is 6 in. in diameter or larger. When the weld is completed, pipe ejectors actuated by air cylinders are used to remove pipe from the rolls.

The automatic welding equipment used in this operation is mounted on railroad wheels and can be moved parallel to the rack for 72 ft. The welding arm can be rotated to weld on either side of the track.

Gas Supplies

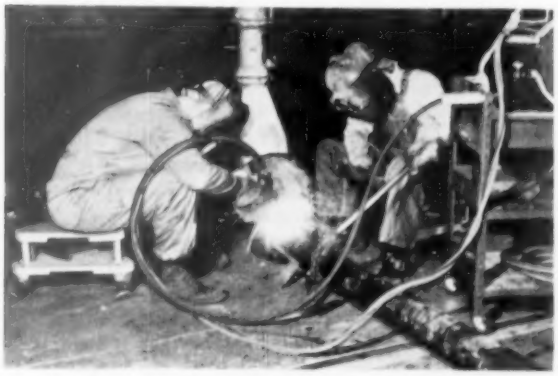
In the other pipe fabricating operation, straight sections of pipe are cut to desired length on mechanical or flame-cutting machines. This pipe is then moved to a layout table and is tacked into sub-assemblies.

(Considerable quantities of oxygen, propane and acetylene are used in field work along with small quantities of hydrogen, nitrogen, argon and helium. With the exception of oxygen and nitrogen, all gases are handled in standard size cylinders. On large turn-around jobs, all oxygen is delivered to the unit in bulk trailers.)

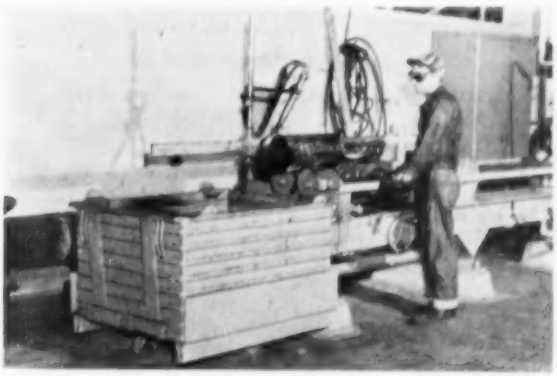
The sub-assembly is moved to a welding area and the first bead is welded manually. Again, welding is completed with submerged-arc equipment if the pipe is 6 in. in diameter or larger.

Completed sub-assemblies are moved to the layout table and the final assembly is tacked together. If one of the legs is short enough, this pipe is handled like the sub-assemblies. If all legs are long, preventing the complete assembly to be turned on rolls, a position weld must be made. Designers at Humble have cooperated very well in designing pipe for easy welding.

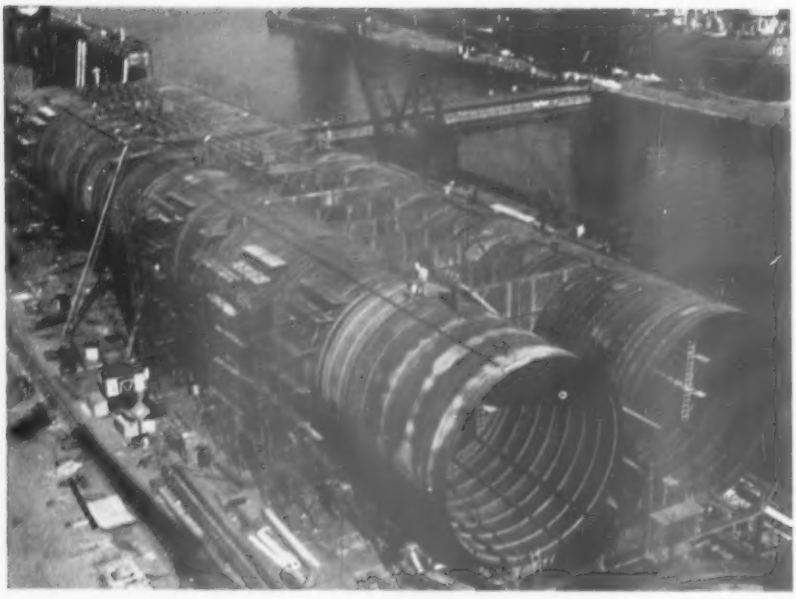
Welding machines are always mounted so that they do not take up valuable floor space. Also, extensive use is made of welding positioners and very little "in-position" welding is performed.



WELDORS repairing this pipe with inert-gas shielded equipment are protected from fumes by exhaust pipe. Safety was a vital consideration in improvements.



BOTH maintenance and fabrication workers make use of this flame-cutting machine. Pipes can be cut and beveled in preparation for welding.



TWIN-TUBE tunnel section, 300 ft long, nears completion in Baltimore shipyard.

Baltimore gets a welded tube

Lying 75 ft below the surface of the Patapsco River, and joining Baltimore's Fairfield and Canton sections, this 1.7-mile tunnel and its 14.3 miles of approaches will be a major segment in a new, $130,000,000 expressway linking highways U.S. 1 on the south with U.S. 40 on the north.

By a Staff Member

ASSEMBLY line fabrication techniques are being efficiently and economically employed by two Eastern shipbuilding firms to weld 11 twin-tube sections for the new Baltimore, Md., harbor tunnel.

When completed, the 6,300-ft-long tunnel will be one of the longest in the world. Comprising this length will be 42 units (21 double tubes) of steel casing, each 300 ft long and 33 ft in diameter.

Both New York Shipbuilding Corp., Camden, N. J., and Maryland Shipbuilding & Drydock Co. of Baltimore have erected layout areas on docks and shipways adjacent to their plants.

The former firm launches its nine twin-tube components into the Delaware River, from which they are towed through the Delaware-Chesapeake Canal into Chesapeake Bay to a fitting-out station at Fairfield. Maryland Shipbuilding Co. launches its two 300-ft sections directly into the Patapsco River.

Fabrication Procedures

Major components of Maryland Shipbuilding's assembly line, which is 1,500 ft long, are a structural steel table, transfer roller bearings, 3-ton winches, a mill plate storage area and two half-section jigs or formers.

Seven-inch structural T-bars, weighing 17 lb per linear ft, are received at the yard's furnace shop in 27-ft lengths. Placed in a gas-fired furnace, four to six of

these T-bars are heated to 2,000 F in 20 minutes.

Taken from the furnace, T-bars are formed on a quadrant die; they are thus shaped to the diameter of skin plate to be added later.

With sheet steel and the T-bar formers on hand, assembly operations follow this pattern:

Special Table

Three sheets of 3/8-in.-thick steel, 8 ft 2 in. wide and 52 ft 4 3/8 in. long, are pulled from the storage area onto the structural steel table. This table, which stands 3 ft high, was fabricated from six rows of 7-in. inverted ship channels running longitudinally. Transfer roller bearings in the channels are spaced every 2 ft over the entire 234-ft length of the table.

Steel sheets are aligned against transverse and longitudinal stops, and they are trimmed to exact size by multiple-torch flame-cutting machines. A transverse aluminum carriage, powered by a variable-speed motor, carries six 24-in., three-barrel torches over the plates. Four of the torches are paired and set 8 ft apart.

Two torches on the ends of the carriage are fitted with angle heads to flame-cut 30-deg bevels in the plate edges. Bevels later form 60-deg circumferential butt connections when the two half-sections are fitted together. Acetylene pressure is set at 23 lb, and oxygen pressure at 40 lb, for the 16 in. per minute cut.

Winches and cables pull the flame-cut sheets onto the fitting section of the assembly table. The edges to be welded are faired and tacked with E6010 electrodes.

Welding Operations

The assembled plate is then moved onto the first half of the table's welding area, where longitudinal edges are wire-brushed and joined by submerged-arc welding. Another aluminum carriage carries two submerged-arc welding heads over the plate.

The first welding pass is made at 400/450 amp and 28/30 volts. Carriage speed is 15 ipm. Two qualified weldors follow the machine as it traverses the plate, cleaning slag and inspecting the weld. Defects are immediately chipped and rewelded.

Following this first pass, the plate is moved forward two feet and gripped by three fork-type hinges. A 30-ton crane, using a balance beam and plate clamp, lifts the free end of the plate and flips it over.

With this operation, the plate now lies at the end of the assembly table. A second welding pass is made at 700/750 amp, 30/32 volts, and a travel speed of 20 to 21 ipm.

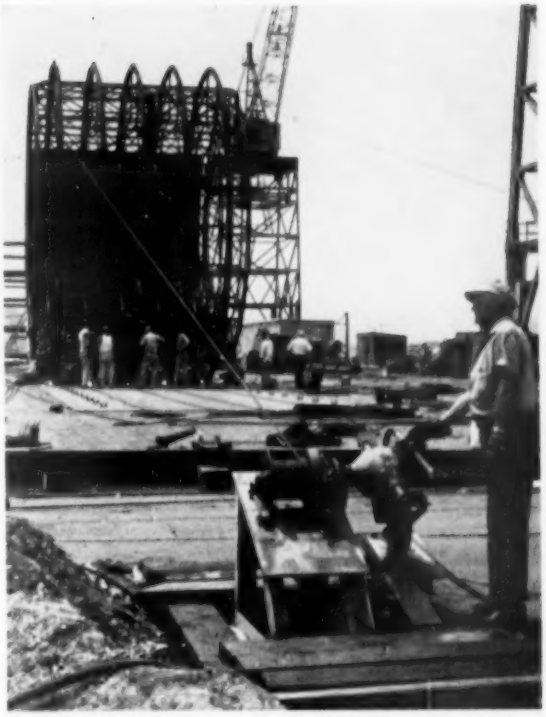
Trimming and Forming

Welding completed, the plate is squared so the ends may be flame-cut. A single torch bevels the edges so that, when sections are fitted, the ends will form 60-deg butt joints.

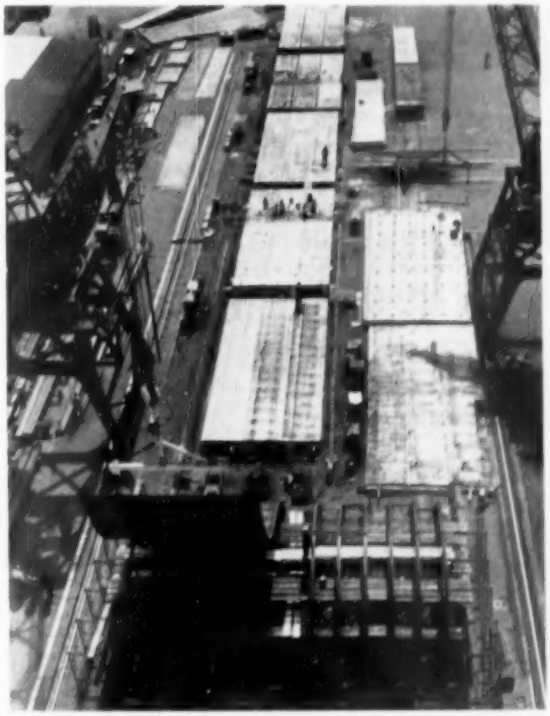
Ten feet from the end of the assembly table are half-section jigs. The quarter-segment T-bars, with web upright, are fastened to the jig by wedges and clamps, then butt welded to form a half-segment.

The free end of a plate nearest to the half-section jig is fastened in an angle step. Weldors tack the skin plate to T-bars at this point, and a 30-ton tower crane begins to lift the plate and drape it over the jig.

As the plate comes in contact with the jig, weldors



ROLL-UP method is employed by New York Shipbuilding Corp. to form tunnel sections. Weldors tack skin plate to circular T-bar rings as spider is slowly rolled by two air winches.



ASSEMBLY area, 1,500 ft long, shows how Maryland Shipbuilding Co. workers flame-cut and weld plates, then drape them over half-section formers.

HEATING torch dries out moisture in butt joint as submerged-arc welder on boom makes circumferential weld inside tunnel section.

continue their job of tacking. When the crane looses the plate, three 2-ton chain falls pull the free end into position against the jig and the last tack welds are immediately made. The completed halves are now ready to be joined into a whole tube unit.

The "New York" Way

Up to this point, New York Shipbuilding Corp. has achieved essentially the same results, with the notable exception that the entire tube has been formed in one piece rather than in halves.

Naturally, however, there are differences in techniques. Here is the way New York Shipbuilding starts from scratch:

Exactly 2,403 sheets of 3/8-in.-thick steel plate are cut to a 6 ft 8 in. width and a 34 ft length on a flame-planer set up at the job site. Plate edges are cut square for submerged-arc welding.

Nine of the plates are moved to the assembly area and are grouped for welding. A special turning jig, which operates much like the covers of a looseleaf notebook, holds the plates. The first pass, using 5/32-in. wire, 550 amp and 31 volts, is made at a speed of 20 to 22 ipm.

After this pass is made, the giant jig is folded shut by a crane and the edges are clamped together. The entire jig is then flipped over and the cover which previously held the plate is swung back, exposing the unwelded side of the plate. A second pass is made with 650 amp, 33 volts, and a cutting speed of 18 to 20 ipm.

Rolling Operation

Completed skin plate assemblies are skidded to a storage area where run-off tabs are removed. Access holes, concrete hatches and concrete grout holes are flame-cut from the plate while it is still flat.

Circumferential frames are prepared while this work is going on. T-bars are received at the assembly area in formed quarter sections. These segments are cut to exact length, then placed in special jigs for welded assembly. T-rings, five at a time, are clamped securely in position on a rolling "spider."

The spider with its T-rings is then set on one end of a skin plate. Tees are welded to the skin for about 6 in. to make certain that the axis of the spider is square to the plate assembly.

Two air winches slowly pull the spider forward, wrapping skin plate around T-frames. Six weldors make 3/16-in. double fillet welds as rolling progresses, using 7/32-in. E6020 electrodes. When rolling is completed, excess plate is flame-cut away and a butt weld is made from the inside. The spider is then unclamped and removed from the roll.

Final Forming

Maryland Shipbuilding Co.'s half-section tube segments are joined by tack welding with E6011 electrodes. Two 24-ft tubes are mounted on turning rolls. Six weldors, using E6020 electrodes, join T-bars to plate while submerged-arc equipment mounted on a 30-ft boom makes a circumferential weld inside the tube. The rolls turn at a speed of 9 ipm during this operation. A finished tube section is 48 ft long when it goes to Maryland Shipbuilding's construction ways.

New York Shipbuilding Corp. joins its tube segments by three's to form 60-ft sections. Backing strips are laid on the outside of the tubes, and submerged-arc welders on booms simultaneously make two butt welds. These welds are made with 3/16-in. wire, using 800/850 amp and 32/33 volts at a travel speed of 17 to 18 ipm.

Welds made up to this point on New York Shipbuilding's tunnel sections are tested by soaping the outside of the tube and blowing a 60-lb. jet of air against the welds from the inside. Before the 60-ft unit is removed from the rolls, doubler plates for access holes and concrete hatches, and studs to hold reinforcing bars are fitted and welded.

On the Ways

Both firms use modified shipbuilding ways to join tunnel components into finished, 300-ft-long, twin-tube assemblies. Welded diaphragm assemblies and stiffeners are mounted on transverse bents on the ways of both firms to receive tube sections.

When tube sections have been welded to these base diaphragms, another set is placed along the tops of the tubes and welded in place. Butt welds between tube sections are manually welded inside and out with E6010 electrodes.

Fitting the end bulkheads is the final welding procedure in both yards. These 5/8-in. thick plates, each with welded stiffeners, collars and hood plates, weigh approximately 75 tons. Fillet welded to the tube ends, they insure watertight integrity.

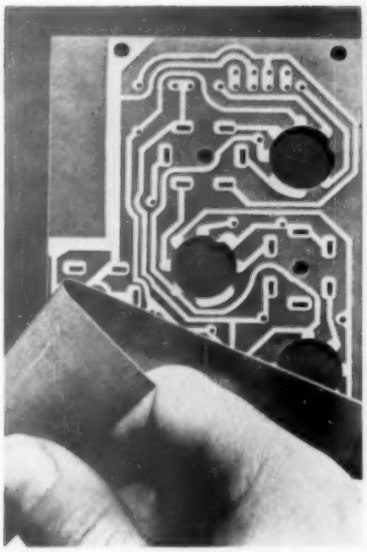
After being fitted out with interior rings of concrete and stretches of roadway slab, the twin-tube sections are floated into position and sunk in a dredged trench. Each of the tubes in the completed tunnel will be tiled and lighted. The two-lane roadways in each will be 22 ft wide, and there will be 2-ft walkways. Vertical clearance will be 14 ft.

The Value of Maintenance

Everyone knows oxygen and acetylene leaks are hazards to the weldor, his equipment, and the shop. Many forget, however, that little leaks in welding or cutting apparatus, or in piping systems, can waste a lot of gas.

Periodic checkups and tests of all equipment will reduce hazards, as well as the unnecessary cost of wasted gas.

—Linde *Tips*



RESIN adhesive is used here to bond backing to a printed circuit for electronic applications.

CHEESECLOTH impregnated with a resin adhesive is used to bond sheet metal facings and honeycomb core by aircraft manufacturer. Cloth sticks at points where parts must have high-strength bond.

Part II:

The how and why of adhesive bonding

BY SAMUEL MUCHNICK

A SURFACE treatment for aluminum recommended by Wright Air Development Center results in joint strengths greater than 5,000 psi. Since these values approximate the yield strength of 1/16-in.-thick aluminum, it is likely that maximum joint strength has been achieved with this metal.

To characterize this surface, experiments were conducted to determine changes in surface properties of aluminum at various stages in the treatment. This was done by means of contact angle measurements with water. These contact angles were measured on the surface as received—following a degreasing with trichloroethylene—and after the "A" treatment (see Fig. 1).

If the treatment had removed or destroyed the contaminating film, a large change in contact angle would be observed. A spreading drop (zero angle) resulted from the treatment, and it could be assumed that the hydrophobic contaminating film had been entirely replaced by an adsorbed water film.

This condition of spreading was observed consistently with aluminum surfaces treated with the recommended "A" treatment, and was invariably associated with maximum joint strength. This correlation is to be expected in view of the increase in free surface energy as the low-free-energy hydrophobic surface is replaced by higher energy water film.

It was concluded from these experiments (Fig. 2) that a basic requirement of a surface treatment for metals is that it condition the surface for very low or zero contact angles against water.

Increased Contact Angle

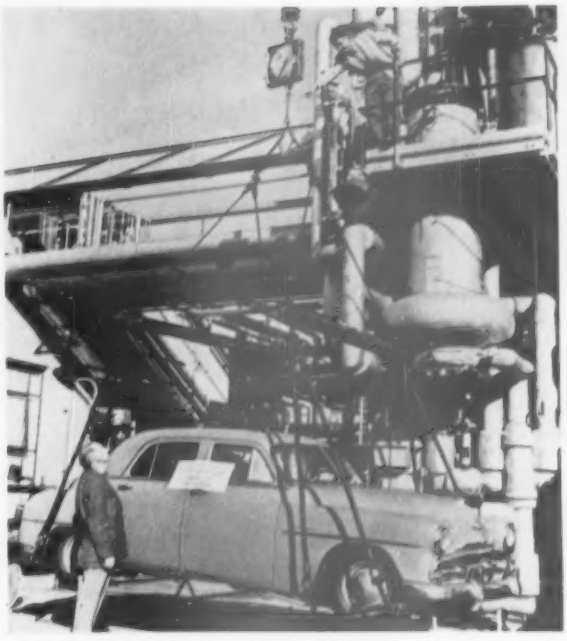
This requirement is clearly shown in the results of an experiment in which aluminum surfaces that made zero contact angles were dried in a 250 F oven for one hour. After exposure to the heat, the contact angle rose to 78 deg and joint strength was 3,621 psi.

Aluminum control specimens that were merely air-dried in a relatively clean atmosphere had made zero contact angles and had an average joint strength of 4,874 psi. The latter is a typical value for aluminum joints bonded with No. 1 adhesive and indicates that curing conditions were normal.

Contact angles on aluminum, as received, ranged from 43 deg to 80 deg with most surfaces averaging 67 deg. The wide range obviously is due to different types of contamination in handling procedures in steel mills.

Average joint strength for these surfaces was 2,442 psi. Degreased surfaces made approximately the same contact angle and had slightly higher joint strengths. This somewhat higher strength probably is the result of reduction in thickness of contaminating films by partial solution in the solvent.

However, this reduction in film thickness produced no change in contact angle. When the "A" treatment



TWO strips of 1⅛-in. steel, bonded with a resin-base adhesive, support a 3,000-lb auto in a test at Emeryville, Calif.

FLYAWAY fuel pod for aircraft is fabricated of a highly formable sandwich core bonded to phenolic-impregnated fiber glass with an adhesive.

was used, the water drop spread rapidly on the cleaned surface and joint strength hovered consistently around 5,000 psi.

In Experiment 3, the average joint strength for six test specimens was 5,173 psi. With improved techniques in applying the adhesive, we are now averaging close to 5,500 psi.

Stainless, Magnesium, Titanium

Correlations between joint strength and contact angles on aluminum suggested a similar approach to the problem of bonding metals generally.

Vigorous chemical treatments of stainless steel and titanium with treatment "B" (Fig. 1) resulted in almost complete removal of contaminating hydrophobic films. Surfaces treated showed approximately zero contact angles with water.

TRAILING edge of jet plane stabilator has been cut in cross-section to show sandwich core. Faces are bonded to core with general-purpose adhesive.

Joint strengths with treated stainless steel surfaces averaged 7,056 psi; treated titanium joints gave approximately the same strengths. Since mechanical properties of these two metals are quite similar, it was expected that with identical surface properties they would have equal joint strengths when the same adhesive was used.

All tests were made with single-lap joints in compliance with WADC requirements. Stainless steel joints, bonded with surfaces as received, made contact angles ranging from 50 to 70 deg, and joint strengths averaged 5,215 psi.

There was considerable scatter in the data. This is characteristic of joints prepared with surfaces as received. Joints prepared with degreased surfaces made 67-deg contact angles, but have more consistent and higher joint strengths.

Degreasing Titanium

Test results with titanium joints showed a large change in joint strength with large changes in contact angles. The material, as received, made contact angles from 50 to 75 deg. These angles did not change drastically when surfaces were degreased.

However, removal of some components of surface film due to solvent action in degreasing resulted in a substantial increase in joint strength, from 1,356 psi to 3,180 psi. When the "B" surface treatment reduced contact angles approximately to zero, average joint strength rose to 6,743 psi.

The attack on the problem of adhesive bonding magnesium followed the lines used on adhesive bonding of stainless steel and titanium. Surface treatments calculated to remove adsorbed organic films to zero contact angles with water were selected.

Successful Treatment

Because of the high chemical reactivity of magnesium, the effect on adhesion of inorganic chemically-bound films had to be evaluated. If these inorganic films are bound loosely to the pure magnesium surface, or if cohesive strength of the film is low, adhesive properties of the magnesium joint will be inadequate.

An unsatisfactory bond could result despite a low or zero contact angle. It was expected that zero angles will occur on MgO, $Mg(OH)_2$, $MgCO_3$, and other magnesium compounds which form on the surface.

Following a number of exploratory experiments, a treatment was found which resulted in a surface that made a zero contact angle and was free of

loose inorganic film. The average joint strength with these surfaces was 3,842 psi (Exp. 11, Fig. 2). This value conforms closely to calculated joint strength based on yield strength of the metal.

In the study of adsorbed film on stainless steel, it was found that thickness rather than chemical nature of the film is important.

Joint Preparation

Joints were prepared with stainless steel surfaces that had adsorbed either water, silicone oil, toluene or paraffin oil, and joint strengths showed no significant variation.

Negligibly small changes were observed after two hours when heated surfaces were dried in relatively clean air or in a hot oven in a clean atmosphere. However, substantial decreases in joint strength were noted when drying was done in an oven in a shop atmosphere.

Rinse water up to a hardness of 200 ppm did not affect surface properties or joint strength of treated metals. We found that thickness and homogeneity of the adhesive film are significant. The presence of bubbles in the film resulted in lower joint strength and considerable scatter in data.

4 Adhesives Used

Four different adhesives were used with identically treated surfaces, and it was seen that joint strengths vary with the adhesive (Exp. 5, 16, 17, 18: Fig. 2). It was not possible to determine in the limited time spent comparing adhesives whether the difference in joint strengths using various adhesives was due to differences in mechanical properties or in bonding agents.

With a given adhesive, the highest joint strength and greatest reproducibility result when metal surfaces are rigorously cleaned. Thoroughness of the cleaning treatment can be determined by the contact angle of a water drop against the surface.

A treatment which renders one metal surface suitable for bonding will not necessarily prepare another metal surface adequately. Furthermore, the chemical nature of the film on a metal surface is not as significant as the thickness of the film.

It is probably clear that procedural techniques have a significant influence upon the strength of an adhesive-bonded joint.

FIG. 1

SURFACE TREATMENTS

"A"
1. Degrease with trichloroethylene.
2. Immerse air-dried, degreased surfaces in following solution for 10 minutes at 155°±10°F:
   - » 30 parts by weight, water
   - » 10 parts by weight, sulphuric acid (specific gravity, 1.84)
   - » 1 part by weight, sodium dichromate.
3. Rinse in running tap water until rinse water is neutral.
4. Final rinse in water at 140° F±5°.
5. Air-dry.

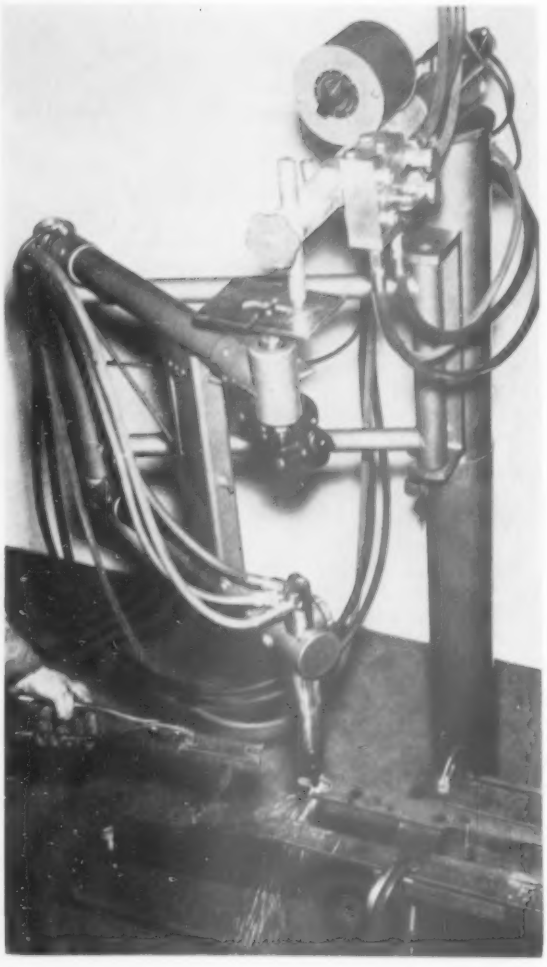
"B"
1. Degrease with trichloroethylene.
2. Immerse air-dried, degreased surfaces in following solution for 15 minutes at 120°±10°F:
   - » 35 parts by volume of saturated solution of sodium dichromate dissolved in 1,000 parts by volume of sulphuric acid (specific gravity 1.84).
3. Rinse in running tap water until water is neutral.
4. Final rinse in boiling water.
5. Air-dry

"C"
1. Degrease with trichloroethylene.
2. Immerse in the following solution for 10 minutes at 160°-190°F:
   - » 3 oz. sodium metasilicate
   - » 1.5 oz. tetra sodium pyrophosphate
   - » 1.5 oz. sodium hydroxide
   - » 0.5 oz. nacconal NR
   - » 1 gal. water
3. Rinse in cold running tap water.
4. Immerse in 20% chromium trioxide solution for 15 minutes at 150F.
5. Rinse in three successive baths of cold distilled water.
6. Final rinse in boiling distilled water for approximately 30 seconds.
7. Air-dry.

FIG. 2

TEST RESULTS WITH ADHESIVE-BONDED METAL JOINTS

Exp. No.	Metal	Treatment No.	No. Specimens	Avg. Contact Angle	Avg. Shear Strength (psi)
1	Aluminum	As received	6	67	2,442
2	Aluminum	Degreased	6	67	2,741
3	Aluminum	A	6	0	5,173
4	Al. panels dried in oven	A	6	78	3,621
5	Stainless	B	12	<10	7,056
6	Stainless	As received	12	50-70	5,215
7	Stainless	Degreased	12	67	6,306
8	Titanium	As received	12	50-75	1,356
9	Titanium	Degreased	12	61-71	3,180
10	Titanium	B	3	10	6,743
11	Magnesium	C	12	0	3,842
12	Stainless	Adsorbed water	6	0	6,641
13	Stainless	Adsorbed silicone oil	6	67	6,643
14	Stainless	Adsorbed toluene	6		6,117
15	Stainless	Adsorbed paraffin oil	6		6,255
16	Stainless	B	6	16	3,378
17	Stainless	B	6	<10	3,970
18	Stainless	B	6	<10	1,943



SMALL notched lug can be flame-cut from 20-ft-long bar stock in half a minute. Machine operator handles stock, and tooling and set-up costs are low.

Production tests have been made to back up the proposition behind this thought-provoking question . . .

Why not flame-cut bar stock?

By John W. Mattingly, *President*
Heath Engineering Co.
Fort Collins, Colo.

FLAME-CUTTING parts from bar stock rather than plate offers many possibilities for automation, and reduces equipment costs and material handling problems. It adds new flexibility to total production scheduling, and opens new application and design possibilities.

During the past 20 years, flame-cutting has gained a tremendous amount of momentum. The demand for huge steel parts for fabrication into heavy weldments led to the development of machines which could carry multiple cutting torches over areas measured in thousands of square feet.

This spectacular and highly useful arrangement demands the use of large heavy plate stock as the inventory material from which both large and small parts are produced. This maximum practice may have contributed substantially to a general concept that large area plates are the best all-around material for production of all part sizes and shapes by flame-cutting.

Competitive Example

That the plate material concept is not always the best practice in flame-cutting can basically be proved by a look at stamping press techniques as a competitive example. Maximum practices in a stamping press set-up are actually a concise example of automation.

Dies are properly arranged in as many stages as required and, to minimize material handling, endless coils of strip stock are fed into the dies. When the set-up is completed, a starting button is pressed and automation takes over.

The broad concept and some specific details of stamping press operations have been profitably applied to flame-cutting. A fundamental example is a relatively small, notched lug, typical of shapes adaptable to this type of set-up (see photo).

One brief torch application produces a complete part at a job rate of one each 0.5 minutes. Indexing to the stop determines length. Material is $\frac{3}{8}$ by $1\frac{1}{2}$ in. hot rolled stock which the operator himself handles in 20-ft lengths. Tooling costs are negligible and set-up time is a matter of minutes.

Considered Factors

Remember that a direct comparative cost analysis with stamping press operations cannot always be made. Examples given are of such thickness and shape proportions that they would not generally be produced by die stamping. If they were, however, rate of production required, die cost and amortization, lack of flexibility and set-up time are additional factors which would demand consideration.

When adaptable, the bar stock set-up obviously in-

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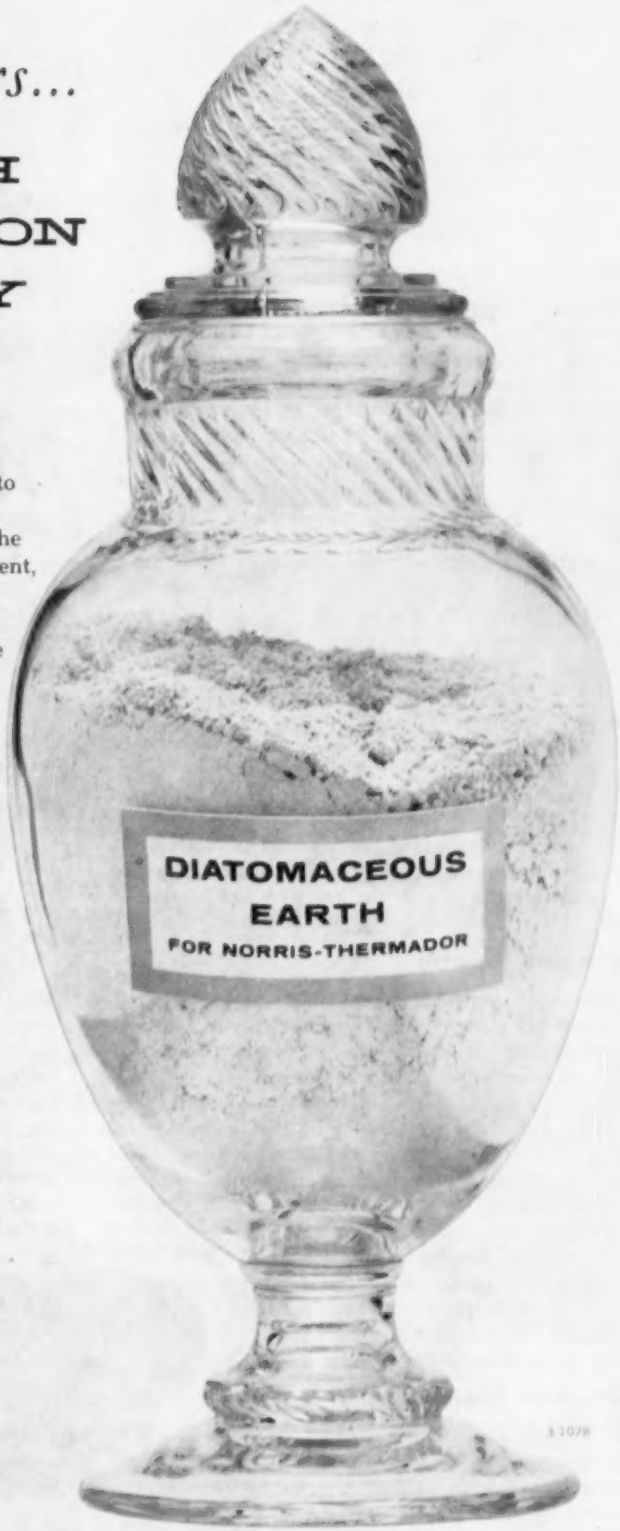

NORRIS-THERMADOR CORPORATION

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creases the rate of production over flame-cutting from plate in a single-torch machine operation. If cut from plate, the time required for torch travel along the parallel side of the notched lug would more than double time per part.

When the material handling burden is taken into consideration and all other operating procedures are accounted for, it is not too difficult to speculate that a single-torch operation using bar stock can equal the net rate of output of machines carrying three or four torches and cutting from plate.

Small-Part Production

Another interesting aspect of the bar stock concept is production of relatively small parts by flame-cutting. The lug illustrated in Fig. I is also cut from ⅜ by 1½ in. hot rolled bar stock, and each cut across the bar produces a complete part, including the bolt hole.

Production of such small parts, even without the cut hole, would not ordinarily be attempted by flame-cutting. However, by adapting the procedure for the use of bar stock, total heat accumulated is held to a minimum and incorporating the cut hole in the operation eliminates such additional operations as handling, locating and the punching or drilling normally employed to produce the hole.

In many instances, savings may be effected by cutting small to medium-sized parts from bar stock instead of plate even though the parts require cutting on all sides. For example, the part illustrated in Fig. II, when cut from 20-ft lengths of ⅜ by 8 in. hot rolled steel, can be handled by a single operator without the assistance of expensive and time-consuming handling equipment.

The operator is working continuously to produce the complete, high-quality part. Use of a double template allows nesting the cuts in the bar with a minimum of waste.

Eliminate Shearing

Recognition of desirable adaptations of the bar stock concept is not always easy. All related factors (particularly handling) must be taken into consideration if maximum advantages are to be realized.

A striking example of a hidden possibility is illustrated by Fig. III. For years this relatively simple part was sheared from ⅜ by 2½ in. hot rolled bar stock. The shearing procedure consisted of cutting to length, then clipping the two angular corners with separate set-ups.

This required handling each piece three times in addition to original positioning of the mill lengths of stock. Normal shear tolerances produced variations in length and shape which, together with distortion of the ends, gave poor welding fit-up.

10% Cost Reduction

Welds joining this particular part into final assembly were required only across sheared ends where shearing stresses joined with welding stresses to increase the tendency for failures.

As an experiment, this part was set up for production with a single-torch machine. Bar stock in 20-ft lengths was positioned and indexed by a single operator. In this case, the part having dissimilar ends,

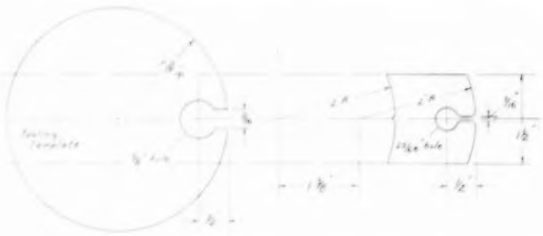

Figure I

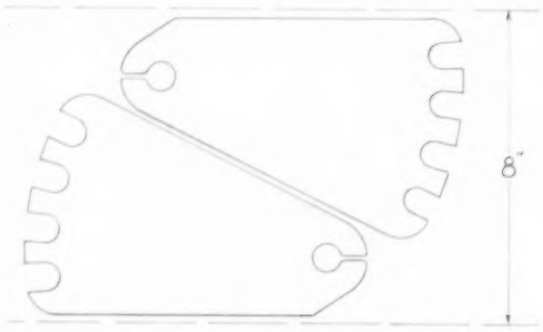

Figure II

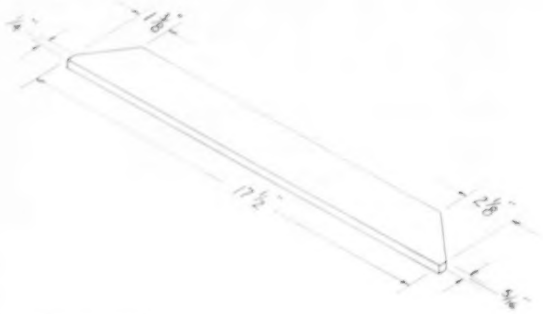

Figure III

length was determined by length of the tooling template.

The tracing rotor was moved manually from end to end of the template in coordination with indexing the length of the material. Net cost of production by flame-cutting was found to be 10% less than by the shearing method (1.62 minutes vs. 1.8 minutes per unit). In addition, substantial advantages were realized from perfect weld fit-up and absence of the shearing stress.

Obviously, time required to start the cut and sever end shapes with flame-cutting is much slower than the net strokes of the shear. But this example clearly sifts out the cost of handling a part as it is processed through multiple stages of production. Whenever this handling-in-process time can be eliminated, the potential for saving is tremendous.

Adaptation of the techniques and fundamental concepts outlined may be extended to reduce production costs of other parts more complex in shape or larger in size. Specific details, such as the cut holes illustrated, are of tremendous significance in reducing costs and obtaining maximum production per unit of capital investment in equipment.

Hammer is held in jig on bench. Form around hammer is built up with firebricks and carbon blocks.

NOVEL WELDING PROCEDURE for Rebuilding Mill Hammers

A large Western tile manufacturer faced the problem of reducing tremolite, a calcium magnesium-silicate material used in real-clay tile. Ordinary hammer mill hammers had too short a life due to the extremely abrasive properties of the tremolite. After testing several alloys, Cast Stoodite was selected as the best, with improvement in both production and service life. Then, by a simple change in rebuilding procedure, *hammer life was again multiplied 300%!*

Although using ordinary arc welding equipment the new technique borders on the casting process. A jig for holding the worn hammer was designed in a permanent bench setup. Two firebricks and carbon blocks were clamped to form a mold around the hammer. As Coated Tube Stoodite was manually welded to the worn hammer, two additional sticks of Cast Stoodite were fed to the arc by hand. Stub ends of Stoodite were salvaged by adding to the molten puddle. When the hard metal reached the proper level the hammer was removed. A light wash-pass smoothed up the finished piece. Welding is continuous to avoid risk of hammer breakage. Welding time averages 20 to 30 minutes—faster than normal and is less costly than use of a casting. Deposits are sound, free of inclusions and securely bonded to the base metal.

Notice that two rods of Cast Stoodite are manually fed to the arc. The stinger is Coated Tube Stoodite.

New, worn and rebuilt hammers are illustrated above.

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Bridge builder creates . . .

A useful new role for end-welded studs

WITH the erection of the first composite steel-and-concrete bridge using end-welded studs as shear connectors, a new role has been created for stud welding. The bridge spans the Bad River at Fort Pierre, S.D.

Engineer K. R. Scurr of the South Dakota Department of Highways designed the continuous five-girder structure. He justified the substitution of studs for steel angles originally specified by stating that "studs permit concrete to be compacted more satisfactorily, so that interaction between the concrete slab and steel beams is assured."

Distortion and warpage caused by hand welding other shear connector types to bridge girders is "absolutely eliminated" through the use of studs, according to Scurr.

Time Reduction

Egger-Scudder Co., Sioux Falls, S.D., handled the stud welding contract. It estimated that stud shear connectors were end welded to girder flanges approximately four times faster than would have been required to hand weld other equivalent shear connectors.

Although the welding work was done in the shop and trucked 200 miles to the job site, only two studs were bent in handling. Shop time reportedly was reduced due to the elimination of tack welding, shearing, grinding and other machining associated with shear connectors.

Shear connectors are used in the positive moment sections of the Fort Pierre bridge girders. All five sections are approximately 68 ft long, and studs are welded to 14-in. flanges.

End-welded to girders in lateral rows of six, a total of 8,300 granular, flux-filled studs were used on the job. Studs were ¾ in. in diameter and 4 in. long, with upset heads. A heavy-duty stud welding gun was used with a 2,000-amp generator as power source.

Steel Sheet Liner

Operators welded studs at the rate of five to six a minute with the aid of a special wooden loading frame. The frame held six studs in a row, properly positioned over the girder, so the operator had only to fix his gun and pull the trigger. Studs were spaced on 2-in. centers in the rows, which were 12 to 24 in. apart.

Wooden falsework, lined with corrugated steel sheets, was erected after girders had been put in place on the job site. Concrete was then poured, and the sheets were left in place after the framework had been removed.

TOTAL of 8,300 ¾-in. diameter studs were used as shear connectors on Bad River bridge construction.

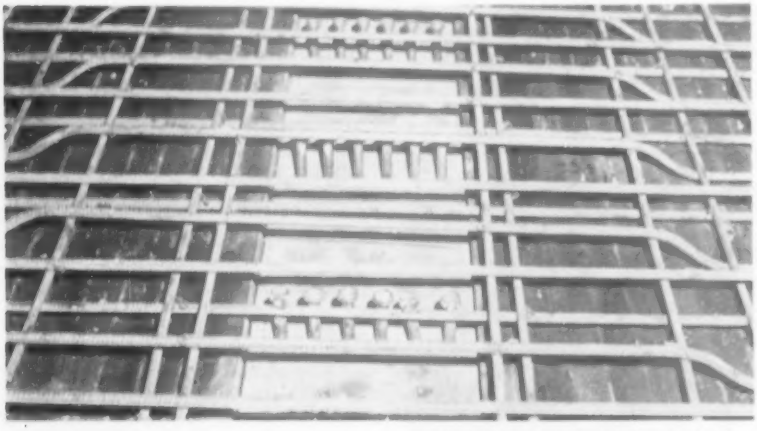
A clean design, flexibility in stud placement and spacing, and little concern for location of the transverse slab reinforcement were major rewards cited by engineer Scurr. He also found studs convenient as aids in spacing mat for reinforcing bars.

Spacer bars were tack welded to the studs and the mat was then fabricated with positive support to spacer bars.

A test program of stud-welded shear connectors and fatigue tests of bare studs carried out in 1954 and 1955, led to the use of flux-filled studs on the Fort Pierre bridge and in other similar applications. Stud dimensions recommended as being most economical for shear connectors on the basis of tests were ¾ and ⅞-in. diameters and the 4-in. length.

In addition to the bridge work, stud shear connectors were used in structural framework for a research laboratory erected recently in Poughkeepsie, N.Y. Other composite buildings now under construction also are employing studs as shear connectors.

End-welded studs, used in connection with reinforced concrete, may be employed as concrete anchors in curbing and as basic fasteners for window assemblies and other preassembled components. In the latter case, studs are end-welded to steel inserts cast in concrete.



—Photos courtesy Nelson Stud Welding

SPACER bars were tied or tack welded to studs, giving support to fabricated mat. Upset stud heads will tend to prevent vertical concrete movement after hardening.

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Monel cylinder Dynamited into fan hub

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Proves soundness of welds with "130" Monel Electrodes

Fast method of fabricating this Monel fan hub proves strength and soundness of welds with "130" Monel* Electrodes. As you can see, dynamite shaping causes no cracks in tough, ductile Monel* nickel-copper alloy.

"Dynamite die molding" solved a problem for the Moore Company of Marceline, Missouri. They wanted to cut production costs on their line of ventilating and cooling tower fans, and at the same time take full advantage of the strength and corrosion resistance of Monel nickel-copper alloy. This shaping method costs them *only 15 per cent as much as spinning: does a much faster and better job.*

Ease of welding with "130" Monel Electrodes plays a part, too, in speeding fabrication of these Monel fan hubs. And "130" Monel Electrodes not only give strong, sound welds, but also *welds that are as corrosion-resisting as the base metal.*

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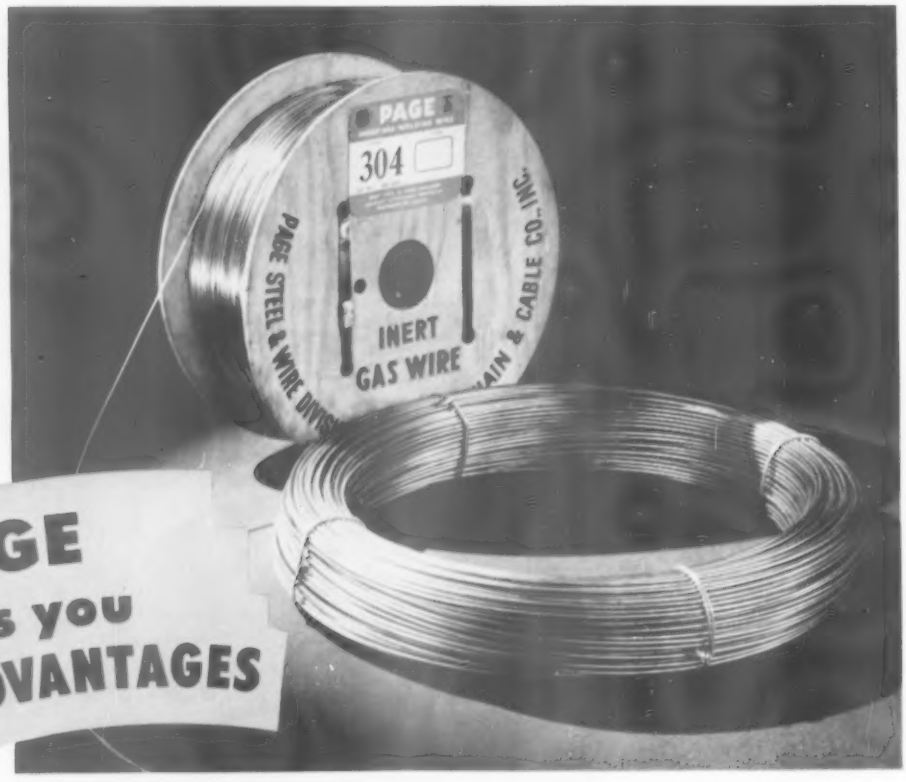

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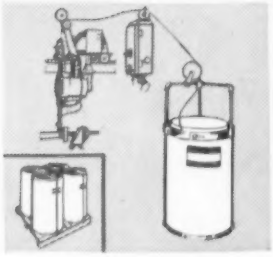

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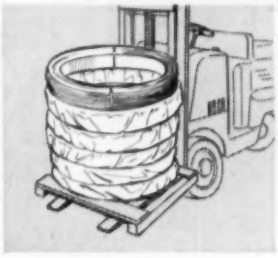

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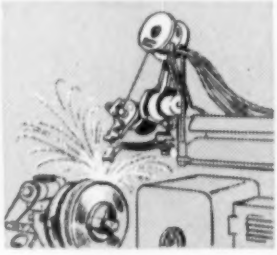

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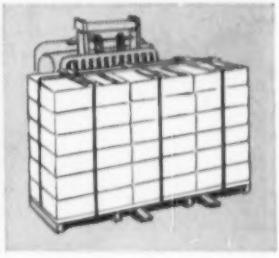

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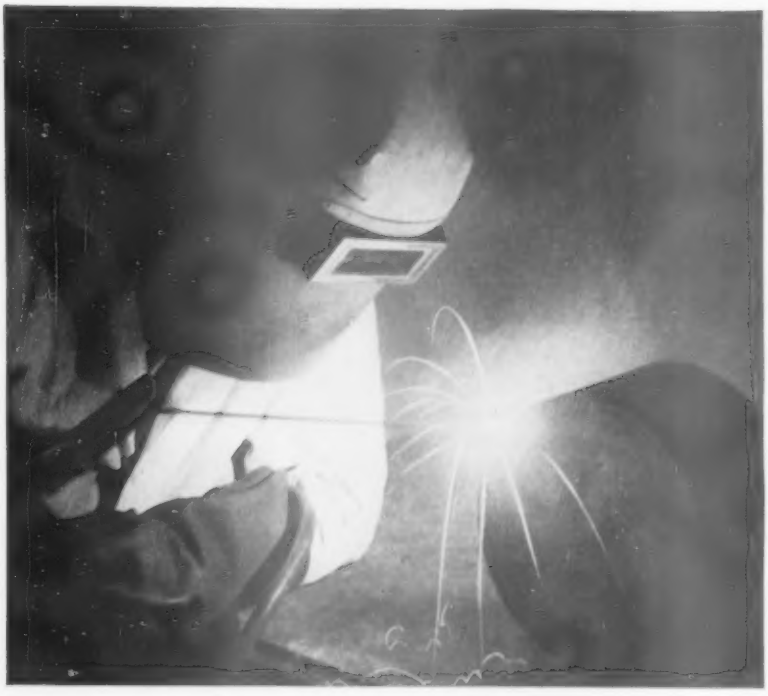

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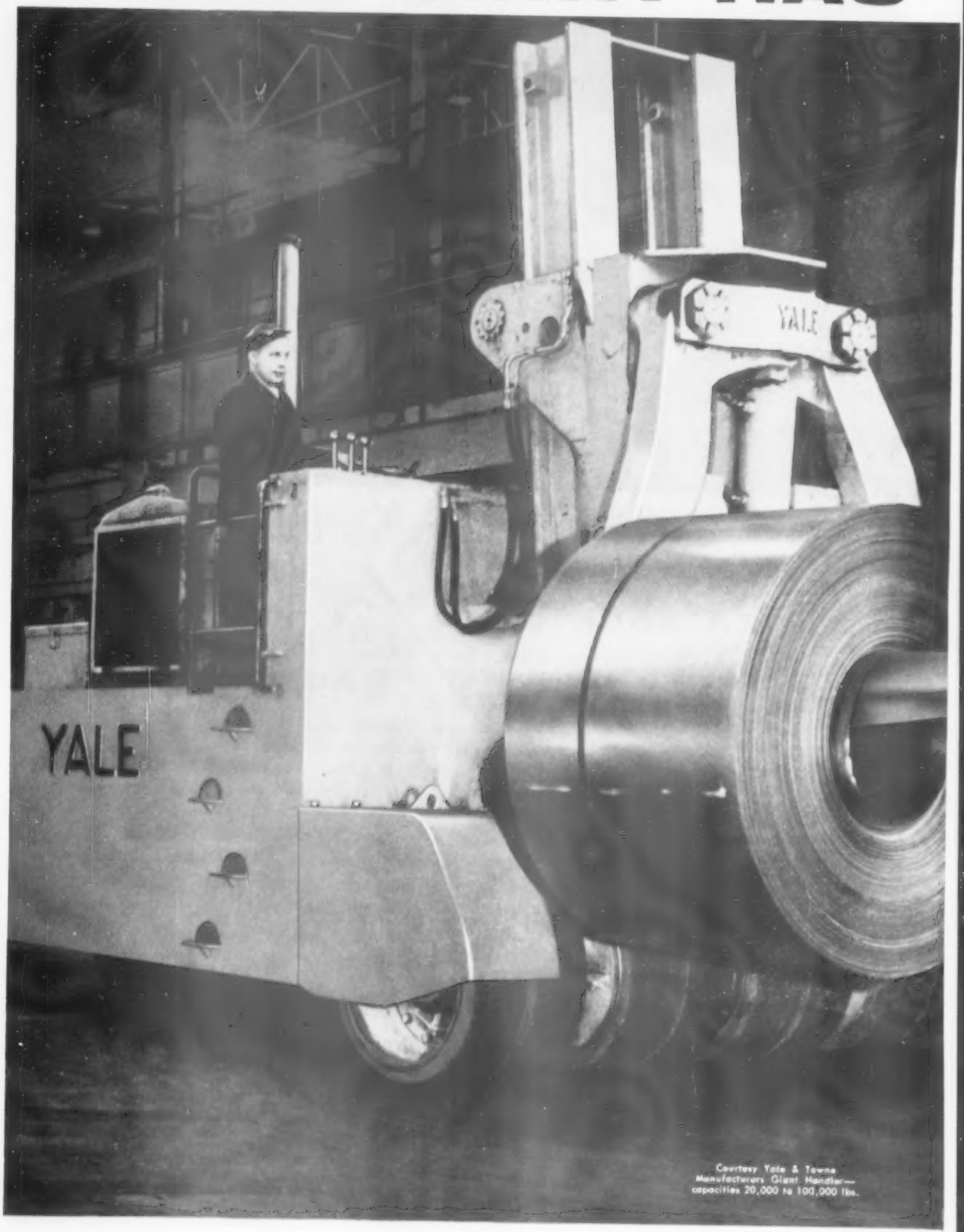

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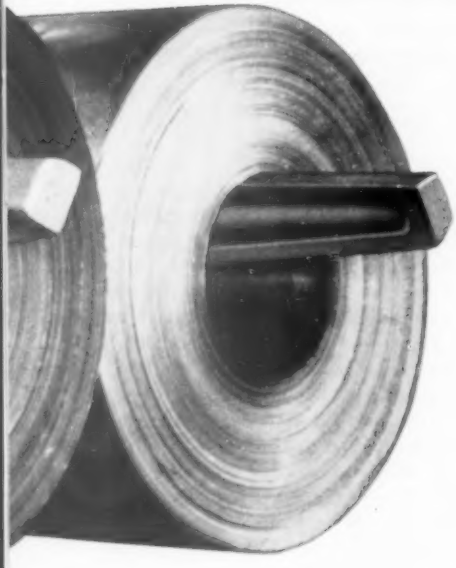

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Dave Buerkel is the welding representative who worked with Yale in selecting electrodes to be used on this and other models. More than a salesman, he's a welding specialist, ready and fully-qualified to help with any welding problem.

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WELDING PRODUCTS DIVISION

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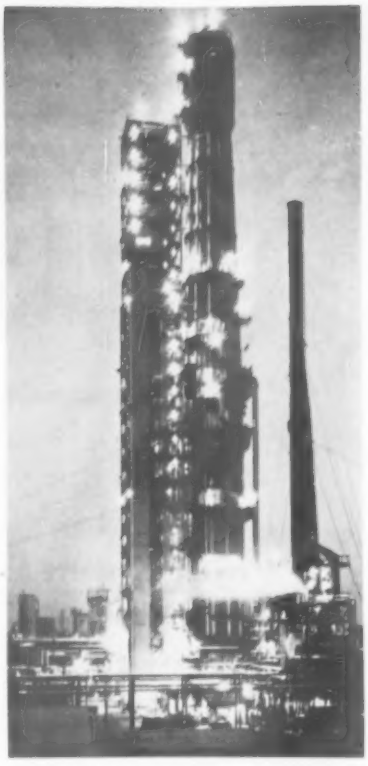
Stress relief under any circumstances takes infinite care. Problems double, however, when it's necessary to perform the work *after* installation. Here's how one firm handles such situations.

REACTOR portion of cat cracker which was converted into a furnace for relief of its own stresses.



BRIGHT against an evening sky, distilling unit stands completed.

Giant unit becomes a furnace in the sky

STRESS relief in large welded structures after final installation is fast becoming an integral factor in both the cost-planning and the engineering phases of large scale fabrication.

This valuable technique isn't limited by size or location of the weldment—which may be 25 ft in diameter, 70 ft tall and mounted 200 ft above the ground.

Chicago Bridge & Iron Co. is perfecting the stress relieving technique through a wide variety of applications in the fabrication of petroleum, petrochemical and chemical processing vessels. Its work thus far has ranged from cat (catalytic) crackers to coke drums to digesters, and out of this experience has come clues to proper procedure and the special equipment needed for particular applications.

The largest job in recent months which typifies the method was a 30-hour stress relief of 71-ft reactor portions of two new "Houdriflow" units. Installed by Sun Oil Co. at Marcus Hook, Pa., and Toledo, Ohio, the units were designed to increase through-put by 40,000 barrels of fresh distillate and 16,000 barrels of recycled fuels per day.

For the job of stress relief, approximately 20 tons of temporary heating equipment capable of liberating 24,000,000 Btu of heat per hour was located 164 ft above ground level. The entire reactor vessel was then converted into a giant furnace in the sky, complete with insulation, precise control of hot gas circulation, and remarkable temperature regulation.

Stainless-Clad Sections

Each reactor section to be stress relieved in location weighed approximately 250 tons—far too heavy to be fabricated as a unit on the ground. Each carried a maze of piping, baffles, fittings, internal heads and special structures within its shell of chrome-molybdenum steel, clad with Type 410 stainless steel.

Wall thickness varied downward from 2½ to ⅝ in. Several different steels of chromium content up to the brittle and air hardening 6% specification were involved. Ten electrode types were used in welding.

There were scores of openings in the reactor vessel; more than a dozen were 6 in. in diameter or larger. The top nozzle was 42 in. in diameter and the main side manhole measured 58 in. in diameter.

This vessel required a stress relief application in final erected position, because: (1) the unit was too massive to have been fabricated and heat treated on the ground as a unit; (2) the thousands of feet of weld had to be heat treated with the body because service temperatures would be high (external insulation rather than internal), and (3) the economics of the case indicated making a furnace of the structure itself rather than building one to enclose it.

Closed Heating Chamber

To set up for the job, CB&I laid a temporary steel bulkhead inside the reactor at the lower limit of the zone to be heat treated. This created a closed chamber which could be fired with hot air through a manhole, and vented through the top and selected side openings (each fit-

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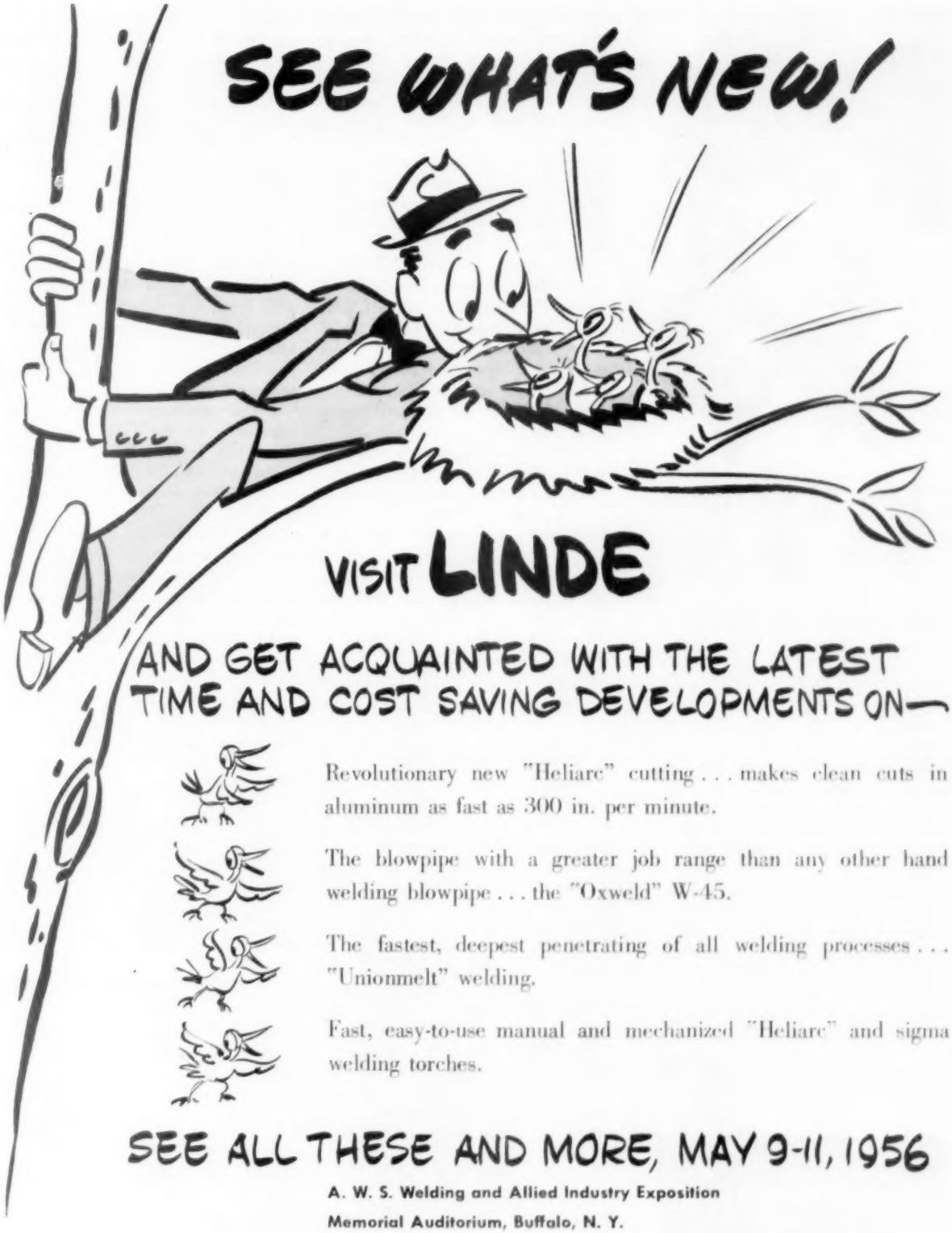

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Memorial Auditorium, Buffalo, N. Y.

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This is but one of many electrodes in Airco's complete line that also includes stainless steel, hard-facing, cast iron, general and special purpose electrodes. Send for the free Airco Electrode Guide which will help you select the right electrode for your specific job. Request catalog 1318-WE.

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ted with a temporary butterfly damper) and bottom openings through bulkheads.

Sides of the shell and head were insulated with temporary layers of magnesia and mineral wool block to an average thickness of 4 in., covering all openings except those few selected for vents and flues. Mineral wool insulation was laid on the temporary internal bulkhead at the bottom.

Heat input was provided by a special box-type furnace with several 6,000,000-Btu-per-hour burners, plus a 50,000 cfm blower (requiring a 100 hp motor) to pump hot gases at 1,400 F from the box furnace through the manhole into the reactor shell. The heater itself measured 9 ft x 10 ft x 24 ft.

All of this equipment was mounted at the 164-ft level on the stair tower of the cat cracker, and it was necessary to reinforce this stair tower temporarily to support 20 tons of firing materials.

Two-inch piping carried refinery gas at 30 psi up the stair tower to a regulator. From here it was distributed through 8-in. pipes to burners in the box furnace. The blower delivered hot air and combustion products at about one ounce of pressure.

Temperature Uniformity

Since the heating cycle was 30 hours (12 hours to heat up, 4 hours to hold at a work temperature of approximately 1,200 F, and 14 hours of controlled cooling) and the vessel so internally intricate, some 30 thermo-couples were distributed over and within the shell at critical points to check temperature uniformity.

A baffle plate had to be used inside the vessel to direct hot gases through the disengager head to the very bottom of the section being treated. These baffles and the bottom bulkhead were subsequently cut up and removed from the unit after the heat treatment. Heat distribution was otherwise manipulated by adjusting butterfly dampers on the selected side and top vents.

Because of these advance provisions for heat distribution (a subtle part of the technique), less than 90 F temperature variation between any two points in the huge and complicated structure was noted at the beginning of the four-hour holding cycle. The ASME code for unfired pressure vessels permits 150 F variation. At the end of the holding cycle the maximum variation was less than 40 F.

The exacting demands of this herculean accomplishment—using the structure itself as a furnace shell with the heat equalizing advantages of hot gas recirculation—is apparent to those familiar with heat treatment.

Thermal Expansion

No small detail to remember in heat treating such large structures after erection is the effect of thermal expansion. In this case the structure was 71 ft tall, and total vertical expansion at heat treating temperatures measured about 9 in.

It was necessary to anticipate this expansion, so the CB&I crew provided slip joints with play in the connection between the hot gas blower and the manhole entrance to the reactor.

Stress relieving large, complicated structures after final placement is not for the amateur. CB&I engineers have perfected the technique over several years and many experiences, and have developed an inventory of box-heaters, luminous burners and blowers which make it practicable.

The economy of a temporary furnace, whether it is a conventional type on the ground or a sky-high unit using the very structure to be heat treated at the shell, depends upon the salvage and re-use value of materials and equipment involved. It relies also upon know-how in determining heat loss and heat distribution.

It should be noted that, where there is a choice, heat treatment in the shop is still the preferred method.

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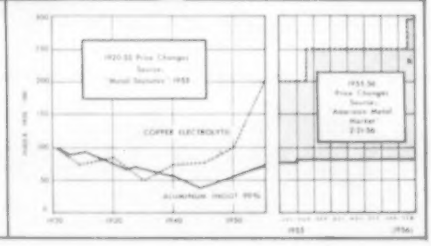
NEW!

Only half the

1 LIGHTWEIGHT to reduce fatigue! Aluminum welding cable is only about one-half the weight of copper welding cable. Thus, it's *twice* as easy to lift and drag around—an important factor in reducing fatigue and increasing efficiency on the job.

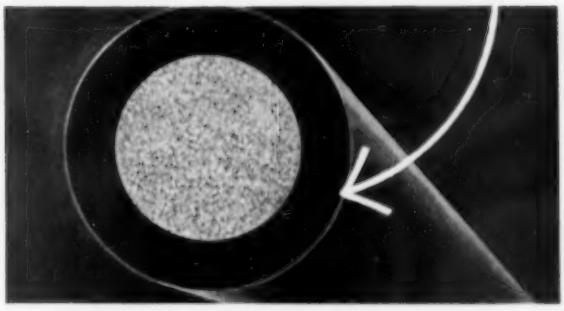
ECONOMICAL! The favorable price of aluminum, when compared to copper, provides important economies. And you continue saving money *even* when you specify aluminum one or two AWG sizes larger than copper to offset its slightly less amperage carrying capacity.



ALUMINUM WELDING CABLE!

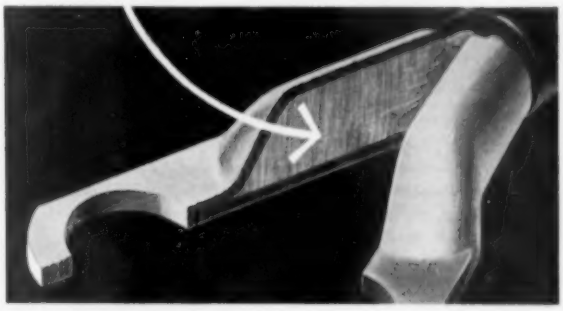
weight of copper cable—plus other important benefits!

2 EXTREMELY FLEXIBLE to make work easier! The fine wires used for aluminum welding cable assure *maximum* flexibility, plus toughness and durability. Aluminum welding cable can easily be looped into a circle with thumb and forefinger—demonstrating the freedom of movement it provides to the welder.



3 DURABLE to withstand hard use! Tough rubber jacket resists abrasion, acids, sunlight and heat. For extremely hard usage, a neoprene jacket is available which offers maximum resistance to abrasion, acids, alkalies, grease, oil, sunlight and heat. In addition, the neoprene jacket is flame-resistant.

4 COOLER to make handling more comfortable! Aluminum welding cable dissipates heat almost twice as fast as copper cable of similar size. As a result, the aluminum cable and electrode holder is far cooler and more comfortable to handle.



5 EASY TO SOLDER for tight copper or brass terminals! Terminal lugs or accessories can be soldered to aluminum welding cable by a simple 4-step method: 1) heat socket or lug barrel with small torch flame, 2) apply non-zinc chloride type flux inside barrel, 3) insert soldering wire while applying heat, and fill $\frac{2}{3}$ full, 4) gently work stripped end of cable into solder socket, remove flame, and allow to cool. Connection is then ready for use. Aluminum welding cable also takes good mechanical connections.

Kaiser Aluminum is a leading producer of electrical conductor for transmission, distribution and service drop lines. In addition, Kaiser Aluminum produces building wire and other aluminum conductor products for industry.

At your request, we will be glad to send you our informative folder, "New Advantages in Arc Welding Cable with Aluminum Welding Cable." Write to Kaiser Aluminum & Chemical Sales, Inc., *General Sales Office*, Palmolive Bldg., Chicago 11, Illinois; *Executive Office*, Kaiser Bldg., Oakland 12, California.

* * *

To take full advantage of new aluminum welding cable, contact your welding equipment manufacturer or your nearby welding supply distributor. Aluminum welding cable is produced for equipment manufacturers by Kaiser Aluminum at the company's Newark, Ohio wire and cable mill.

Kaiser Aluminum

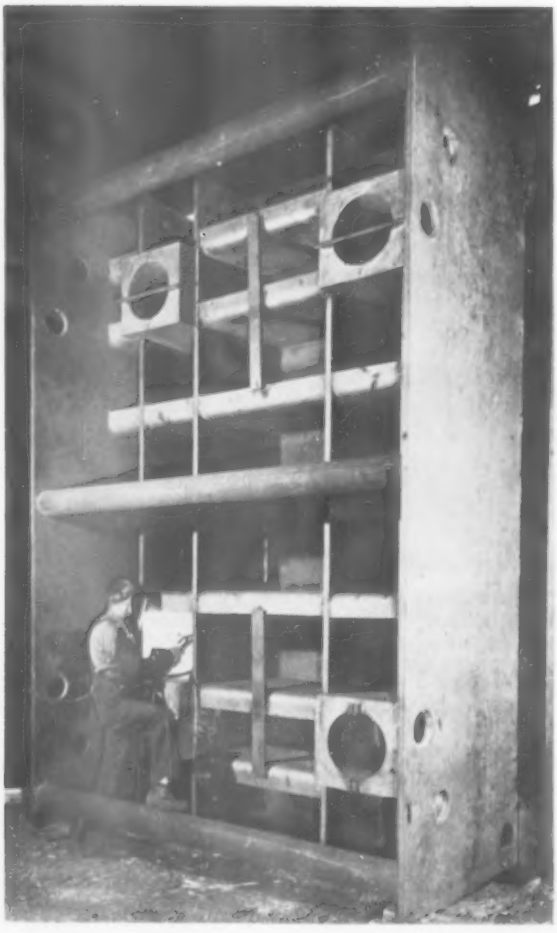
SLIDE weldment (right) was fabricated by automatic submerged-arc and manual arc welding at Falk Corp., Milwaukee. Giant weldment contains 103,000 lb of steel plate and 11,000 lb of steel castings. It will be incorporated in new press at Federal Engineering Co., Detroit.

On the job...

WELDOR completes circumferential weld on pipe component for fire control sprinkler system in sub-basement of Chicago's newest skyscraper, the Prudential Building. An E6010 electrode was used on the 8-in.-diameter mild steel pipe.

—Courtesy Nelson Stud Welding

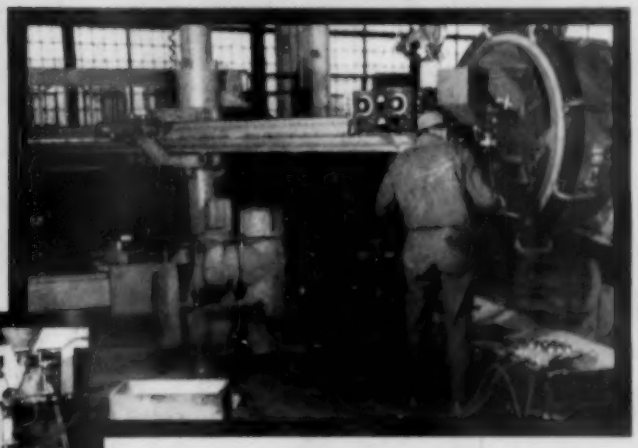
ALUMINUM water heater tanks have three aluminum studs welded to top to hold transformer and support burner. Studs are 2¼ in. long and 5/16 in. in diameter. Argon or helium gas is used to prevent weld oxidation and manufacturer reports cost reduction of 30 cents per heater using welded studs.



—Courtesy Linde Air Products Co.

HARDFACING with a Tig (tungsten inert-gas) torch reportedly doubled service life of hammers used in grain mill. Separated by ½-in. spacer rings, hammers are strung on a rod and bolted together. A ⅛-in. deposit of hardfacing material is laid along 3-in. leading edge of each hammer. Welding current is 1-5 amp a-c, and 20 cu ft of argon per hour is used.

Here's a sure way to speed production and CUT YOUR COSTS without complicated and expensive setups



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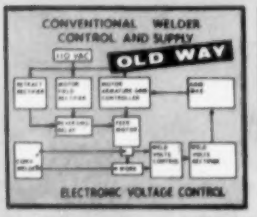

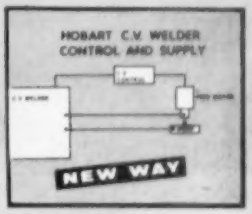

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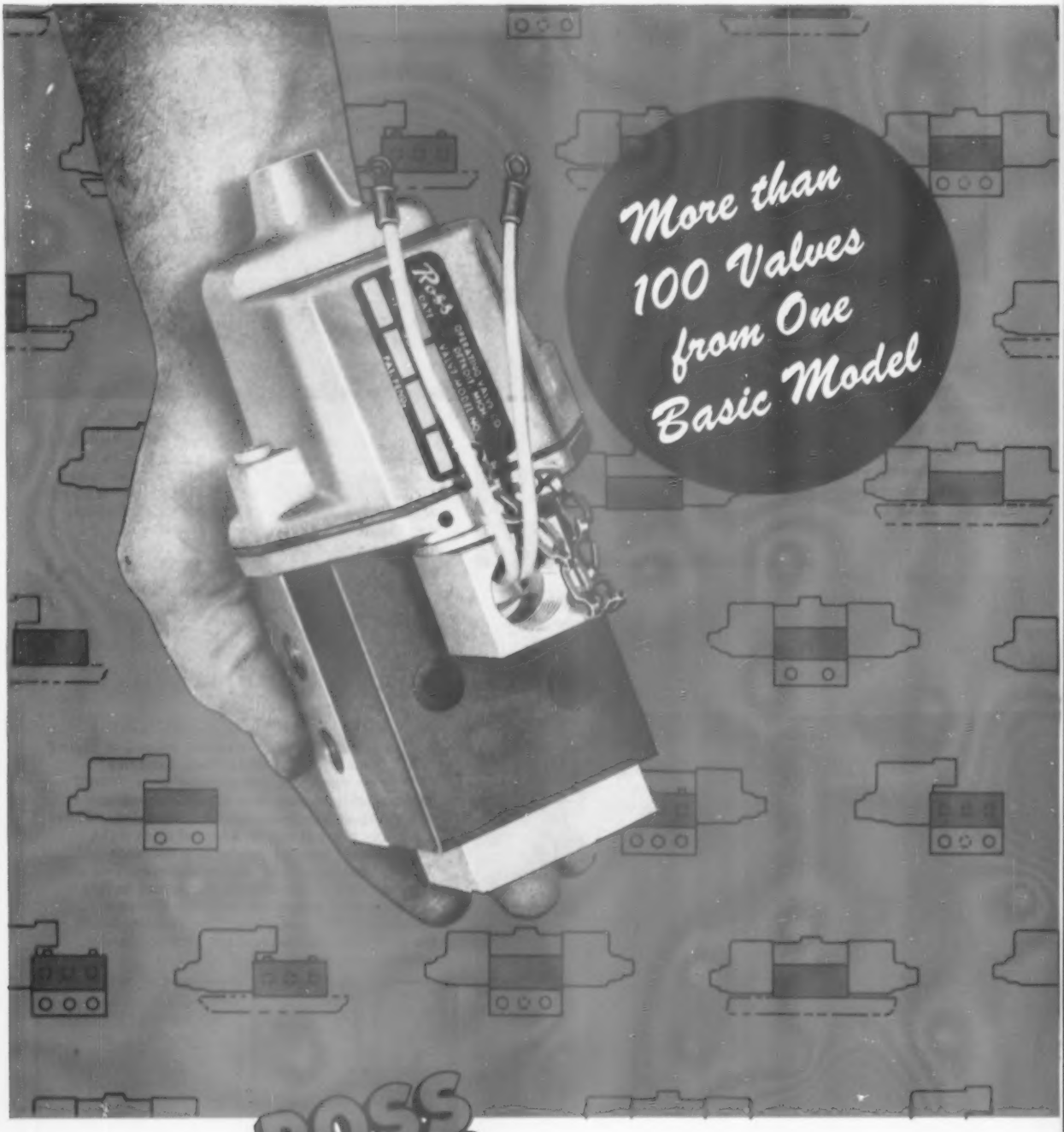

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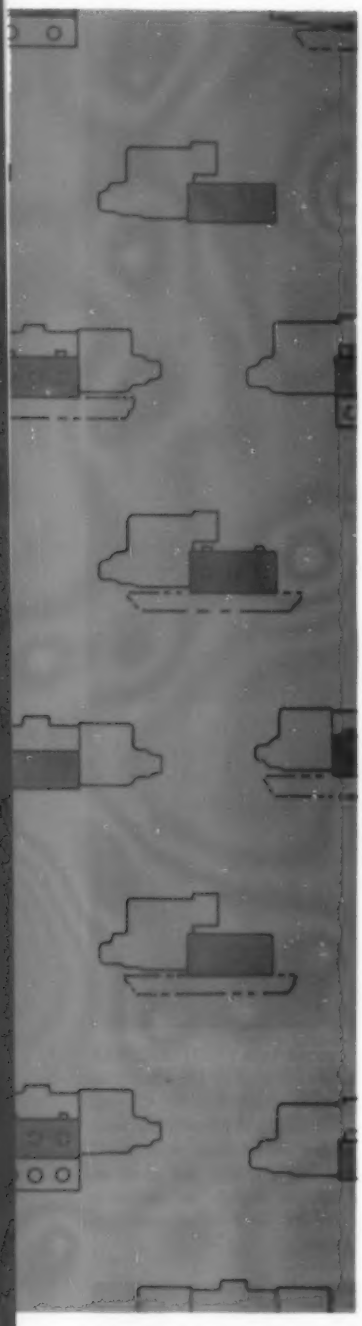

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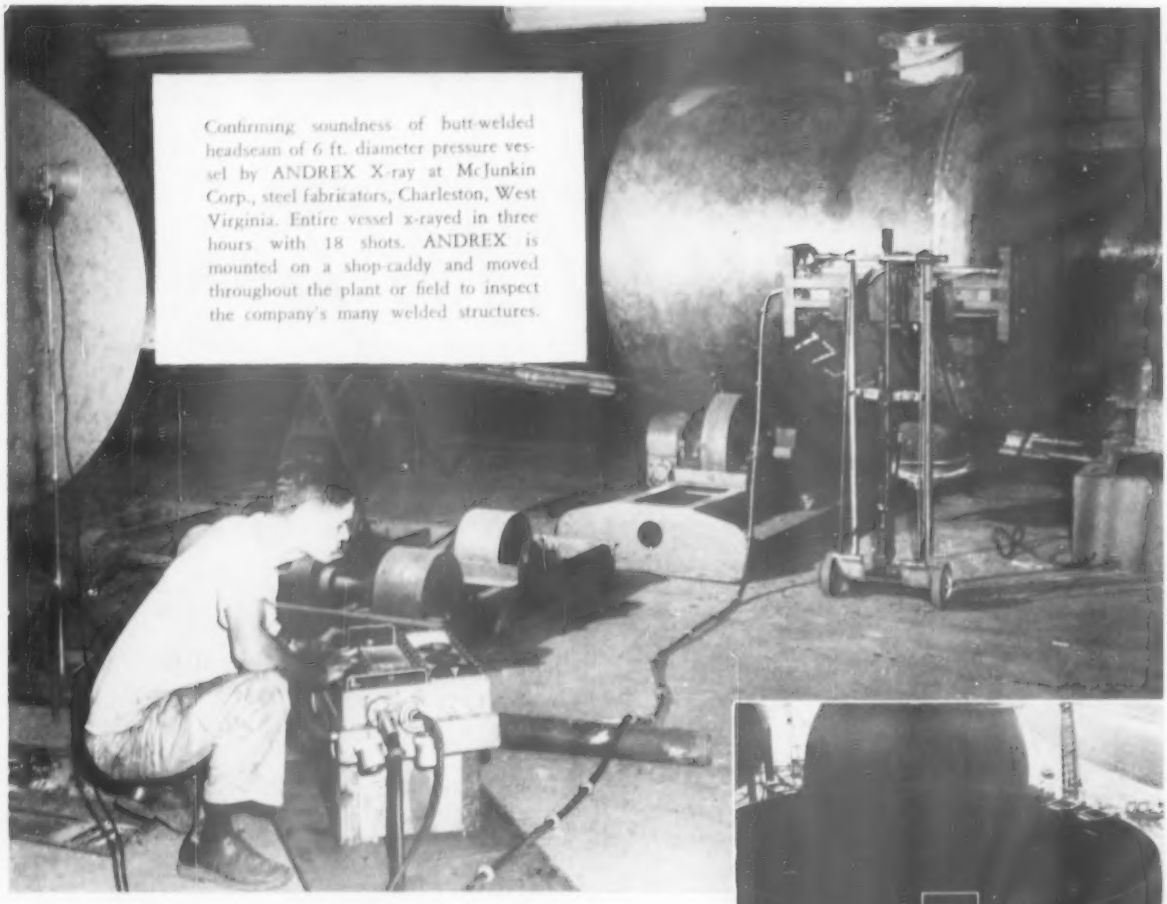

Confirming soundness of butt-welded headseam of 6 ft. diameter pressure vessel by ANDREX X-ray at McJunkin Corp., steel fabricators, Charleston, West Virginia. Entire vessel x-rayed in three hours with 18 shots. ANDREX is mounted on a shop-caddy and moved throughout the plant or field to inspect the company's many welded structures.

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ANDREX, in a setup similar to this one at McJunkin Corp., examines internal stainless steel coils for pressure vessels at Texas Pipe Bending Co., Houston, Tex.

LETTERS .... *from page 10*

keeping up with new methods and putting them to work.

It is very seldom that I get to stay on one job over two weeks. The rest of the time I am expected to do many types of welds without advance notice and in a hurry. For any weldor to do a good job under such conditions, it is worth his time to learn new methods.

I want to add that the practice one has had in the past must be picked up quickly. I think that proper training, the best method and study will teach a weldor how to weld the job best. I have been welding 15 years and find the more I learn the more I want to learn.

The weldors I work with do the same. We can't pick our jobs but must take them as they come. We often run into trouble but figure the answer out ourselves, if we can.

Hubert E. Peterson
Pine Bluff, Ark.

Mig welding

Dear Sir:

Your December, 1955, issue carried a discussion (in "Technical sessions," p. 25) of a method proposed by Kaiser Aluminum and Chemical Corp. in a paper entitled, "Welding aluminum to copper using the Mig process."

I am very much interested in this process as we use in refrigeration a copper condenser and lines against an aluminum evaporator. This joint is made by a flash-butt-welded joint.

E. Martinez Arteche
Cerro Gordo, Mexico

—The writer has been referred to the authors of this American Welding Society paper, L. A. Cook and M. F. Stavish.

Filler metals

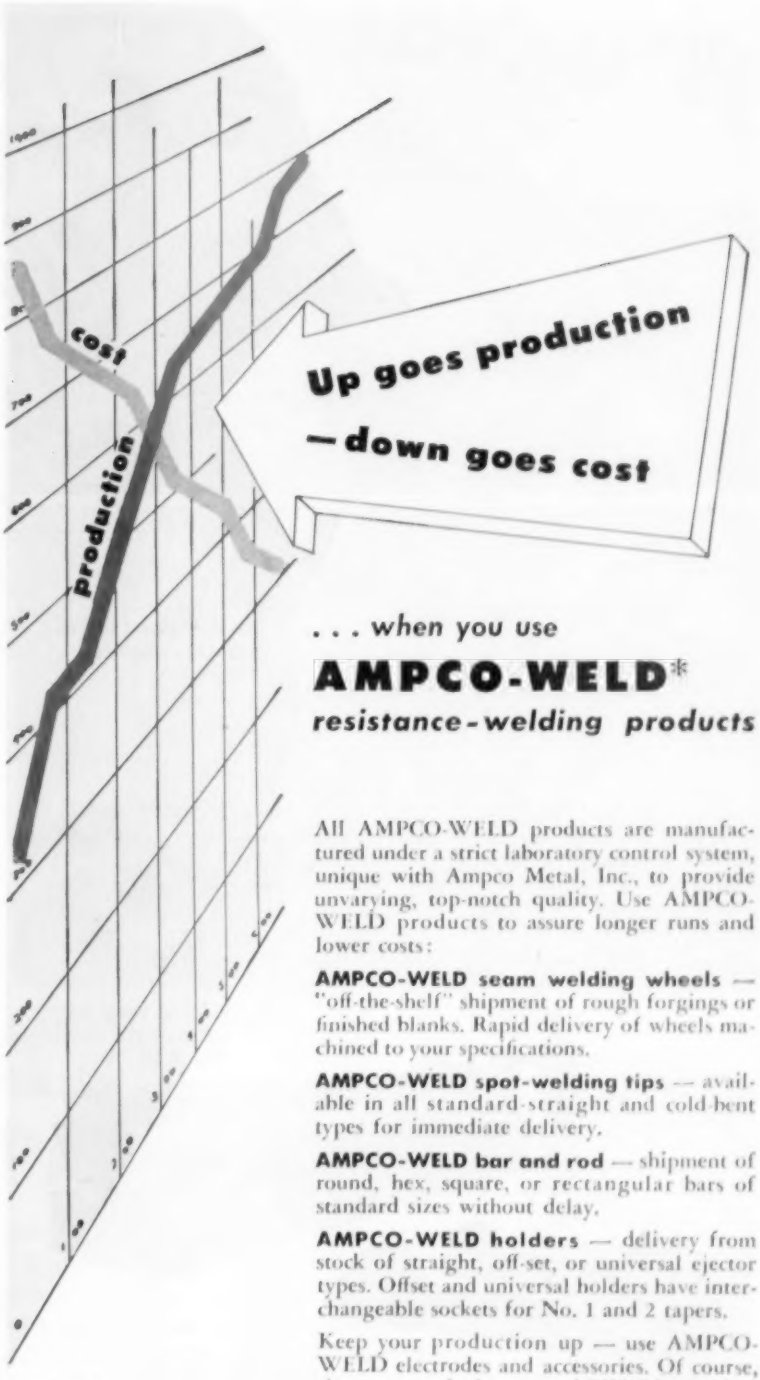
Dear Sir:

The articles on "Filler metals for joining" by Orville T. Barnett have been enjoyed very much. We are particularly interested in deposition rates of electrodes at various current values.

The electrodes of primary concern are the E6013, E6016, E6020 and E6024 types from 1/8 in. diameter through 5/16 in. diameter. We have consulted several manufacturers of electrodes and conducted tests. The results obtained do not agree. We wonder if other such tests have been performed and what the results were.

Lyle W. Kolterman
The Falk Corp.

—Deposition rates of electrodes vary



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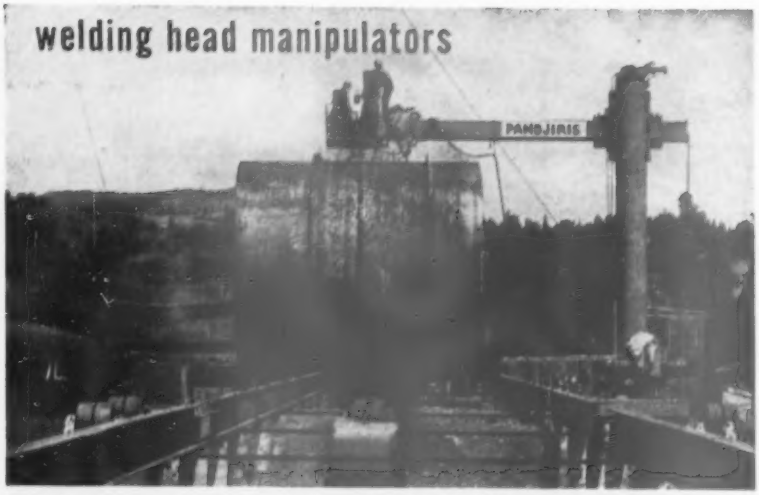

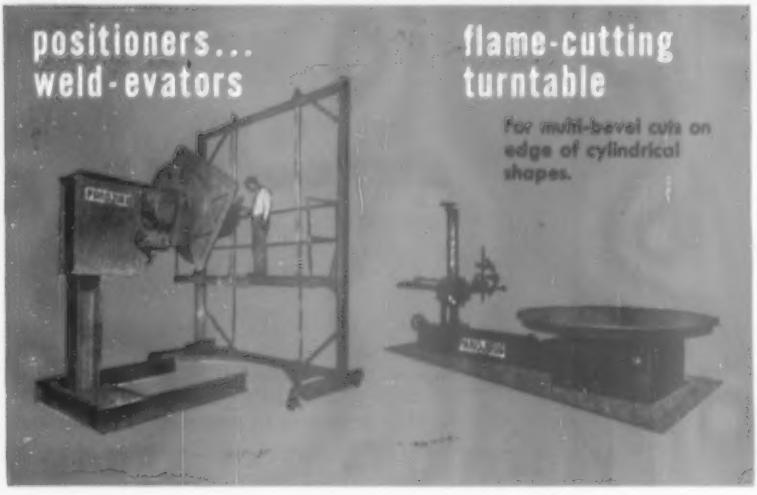

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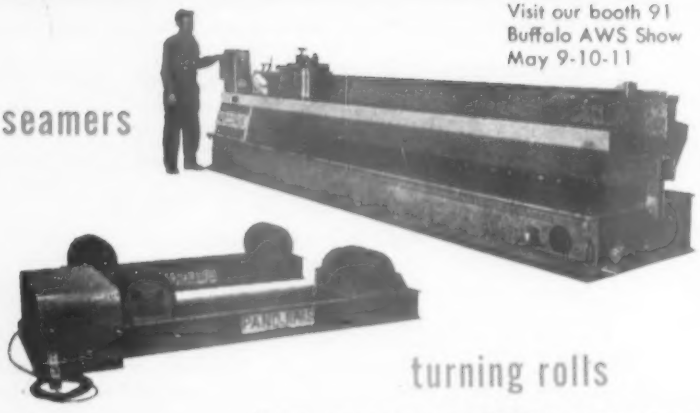

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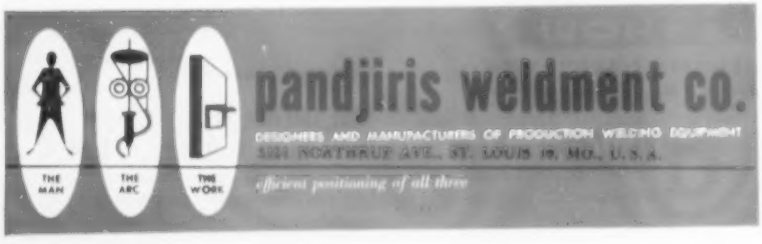
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appreciably, and such data would be too long to list here. Mr. Kolterman has been referred to sources of such material.

Oxypropane cutting

Dear Sir:

I received your February issue and I have read all the articles from the first to the last line.

The article, "Comparative testing confirms oxypropane cutting value," page 22, was very interesting but I believe that you should also publish an article about acetylene vs. propane. This should be written by someone who knows acetylene gas well and its cutting value with oxygen, and we readers will be the judge of which gas is the best.

C. A. Soderberg
San Juan, Puerto Rico

—WELDING ENGINEER tries to present both sides of any controversy. The case for acetylene has often been presented within these pages, and application stories on oxyacetylene processes are a monthly occurrence.

Welded steel home

Dear Sir:

I am intrigued about the article "Lightweight steel plus welding equals low cost home," which appeared in your November, 1955, issue. I wonder about the cost and design of the home shown on page 42.

John Chang
Berkeley, Calif.

—Mr. Chang has been advised to write Brooks Coddington, Columbus, Ohio, and Maxon Construction, Barrington, Ill., for full information.

"Well, I've had lots of experience on flagpoles and smokestacks."

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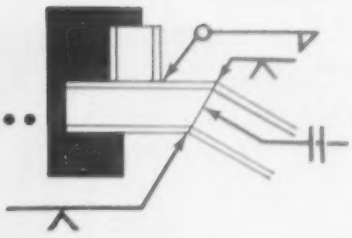

the welding clinic

Here you may find the solution to your welding problems, whether they concern design, production, construction or maintenance welding. Submit your questions for answering on this page.

Flame-cutting steel underwater

Question:

We regularly engage in the demolition of iron and steel structures by flame-cutting, and would like to expand our operations to include submarine salvage. Can you give us some information and tips on underwater flame-cutting of steel, and the type of equipment needed?

Answer:

Because of the varying pressures encountered at different depths, underwater flame-cutting presents a number of fuel gas and torch adjustment problems that usually can be met only by experience. Principal among these is the fact that acetylene should not be used below a depth of 25 ft.

The reason for this depth limitation is apparent in the fact that, if acetylene is normally used at a basic pressure of 20 psi, then at a depth of 25 ft it must be fed at a rate of 32½ psi. Elevated acetylene pressures, whether above or below water, will always lead to instability of the gas and occurrence of reactions which lower oxyacetylene flame temperature.

Expense Demands Speed

When working in depths exceeding 25 ft, it would be wise to use hydrogen or a liquefied petroleum gas. Many divers who work both in shallow and deep waters use hydrogen exclusively.

Initial pressure adjustments for underwater flame-cutting are higher than those ordinarily used on land. Divers with wide experience in this type of operation suggest these basic settings: oxygen, 60-85 psi; acetylene, 12-15 psi; hydrogen, 35-45 psi, and compressed air, 35-50 psi.

UNDERWATER flame-cutting torch (top) has mantled tip which feeds compressed air to protect flame from water during submarine operations (bottom).

—Courtesy Victor Equipment Co.

Diving is costly. Because of this highly important controlling factor, underwater cutting has to be accomplished as quickly as possible. Speed is obtained through the use of large-size cutting tips on all metal thicknesses. This is contrary to common practice, but bear in mind that light-gage metals are cooled rapidly.

An underwater cutting torch is virtually identical to its dryland counterpart; it has, however, a mantled tip that shields the preheat flame from water. Through this auxiliary tip cover is fed a stream of compressed air, nitrogen or oxygen.

Compressed air—the most popular shielding agent—has added value in that it supplies most of the oxygen needed for secondary and complete combustion of the preheating flame. The amount of compressed air released through the special tip cover, however, must be carefully controlled.

"Bubbling" Pressure

Inexperienced operators may release compressed air at a pressure so great that excess air cools the metal being cut. Actually, compressed air pressure should be set just high enough to keep the tip cover filled continually with air. A needle valve attached to the underwater cutting torch allows the operator to keep compressed air just bubbling out of the mantle.

An underwater cutting torch can be lighted and adjusted either above or below water; it is usually a matter of a diver's preference. Submarine lighting is done with an electric spark and creates a small explosion that is neither dangerous nor harmful.

In preheating, allow the upper rim of the mantle to touch the metal. When sufficient heat has been obtained, press mantle firmly against metal; compressed air will escape through the kerf with the oxygen. This procedure allows both oxygen and compressed air to become heated by the preheat flames.

Divers frequently guide the torch head with their free hand to obtain a straighter cut. Neither tip, mantle nor head becomes very warm while immersed. Cuts are started by cutting a hole at some point removed from plate edges; a horizontal or vertical cut can be swiftly made from this point.

Water has a thermo-conductivity 40 times that of air, so provide the operator with hoses that will carry sufficient quantities of oxygen, fuel gas and compressed air.

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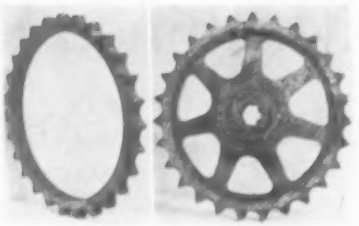

ROLLED steel ring (top left) with flame-cut teeth is tack welded (top right) to old cast steel hub, then submerged-arc welded. Finished sprocket (right) will outwear original.
(Photos courtesy Lincoln Electric Co.)

Rebuilt sprockets

AUTOMATIC Welding Co., Elm Grove, Wis., has developed a method of rebuilding badly worn tractor drive sprockets that is both practical and economical.

Thousands of these cast steel sprockets are presently in use, and an estimated 50% of them will be scrapped and replaced by new castings when they are worn. In the light of the new rebuilding procedure, this waste will be unnecessary.

A flame-cutting unit removes worn teeth from sprockets. A new rim of SAE 1345 steel (0.45% carbon, 1.60-1.90% manganese) is then fabricated by rolling and welding a bar to a diameter which snugly fits over the old hub section.

Teeth on the new rim are formed by flame-cutting prior to fitting the new rim to the hub.

Tack welding lightly joins rim to hub and the unit is mounted on a turntable for submerged-arc welding. The joint is fillet welded on both sides, using a mild steel filler wire.

A sprocket which might otherwise be scrapped is now rebuilt and returned to service at approximately half the cost of a new casting. And further economy is indicated by the estimate of Automatic Welding Co. that the new rolled steel rim will outwear cast teeth by 50%.

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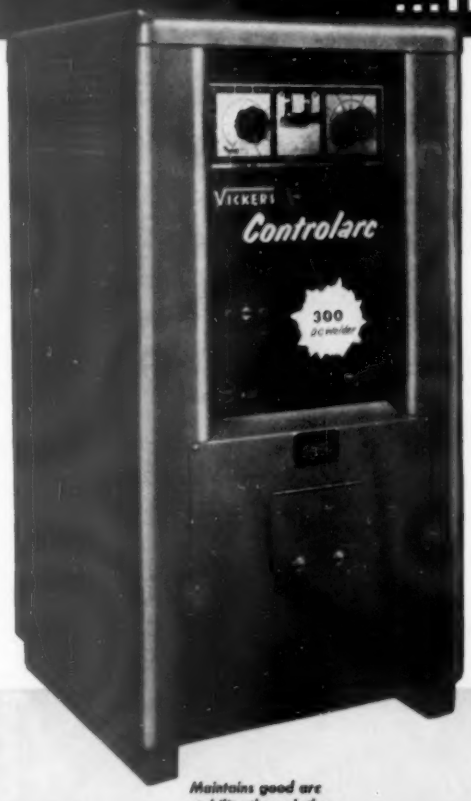

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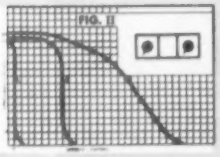
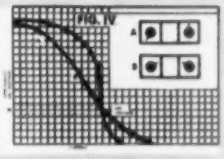


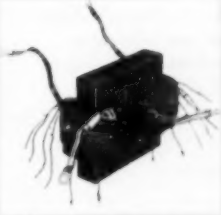
Maintains good arc stability through the complete current range from extremely low to extremely high without range switches.



Can bend the volt-ampere curve to meet the particular welding job being done.

Gives complete automatic arc control in any welding position.

Can strike an arc without the use of high frequency when using inert gas and tungsten at extremely low currents.



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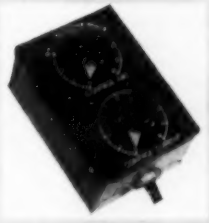

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SOLUTION:

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Airco #20 Bronze Rod. Ideal for braze welding of steel, cast iron, malleable iron, copper, and dissimilar combinations of these metals. Airco #20 is available as a pre-coated rod using Hi-Test Flux. When this rod is purchased bare, either Hi-Test or Marvel Flux can be used for high strength welded joints.

Airco #27 Low Fuming Bronze Rod. For the brazing or braze welding of steel, cast iron, or bronze. Low fuming characteristics of this rod increase its applications in restricted areas. Recommended fluxes for use with Airco #27 are Airco Hi-Test or Marvel Flux. Flux coated rods also available.

Brazing and Braze Welding Flux. A good brazing flux cleans the joint, removes oxides created by heating, and picks up impurities in filler metal. Airco Hi-Test Flux, when properly applied, will accomplish these jobs.

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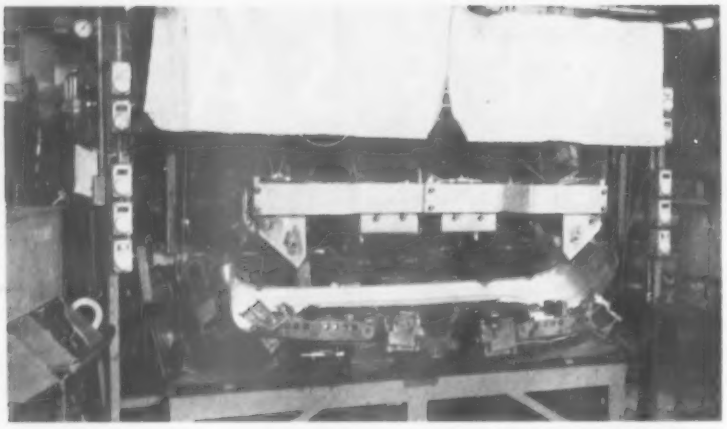
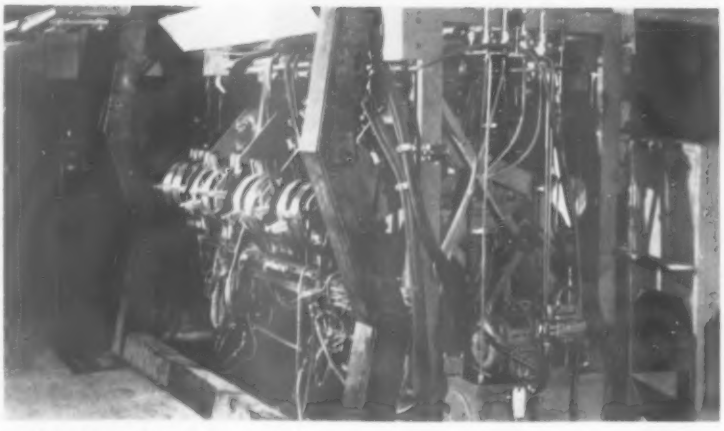


BUMPER and brackets in fixtures, Mig welding heads are ready to be lowered to begin welding cycle. Bumper is 0.10 in. mild steel; brackets are 0.12 in. Curtains are lowered prior to welding.

8 Mig welds at one time!



REAR view of the "octopus" shows eight reels of welding wire and spaghetti-like assortment of hoses.

By a Staff Member

A MIG (metal inert-gas) welding set-up that makes eight simultaneous welds is another example of the trend toward automation in welding. This mechanical marvel, the product of design engineering at Oldsmobile Division of General Motors Corp., Lansing, Mich., is used to weld four brackets to automobile bumpers.

Now in its third year of use, the machine has proved well worth the investment. P. L. Gustafson, general supervisor of sheet-metal processing and design, said the machine's rate of production is better than twice that of the old method—manual arc welding.

The Mig process was chosen as the welding method because Oldsmobile feared flux would contaminate plating baths in which the bumpers are later immersed.

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Investigate this low-cost, labor saving, material saving means of handling flux for industrial uses. Especially valuable where volume work is required for manufacturers' assembly and repair operations.

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At present, Oldsmobile is using argon as the shielding gas, but experiments with carbon dioxide are being conducted, according to Arthur Blastik, welding engineer in charge of sheet-metal welding at the Lansing plant.

Power sources for the eight torches are eight d-c, constant-potential, 100% duty-cycle welders which are located on a catwalk above the automatic apparatus. In this operation the welding machines are being operated at 400 amp, 28-29 volts. Argon flow is 35 cfm.

Oldsmobile uses two brands of 1/16-in. mild-steel welding wire and claims there is little difference between the two.

Distributor's Idea

The whole idea of using this type of machine was born when a welding distributor's agent suggested that an automatic gas-shielded process would probably result in great savings. Although designed by Oldsmobile engineers, the apparatus was built by Industrial Metal Products Co., also of Lansing.

By varying the fixtures, the machine can be adapted for welding operations wherein fewer joints have to be made. With the recent change in models, for example, only four welds need to be made simultaneously to join the brackets to a bumper.

Oldsmobile Division, therefore, is having another machine built to utilize the four Mig heads and welders no longer needed on the original device. Thus, bumper production can be doubled when both machines are in operation.

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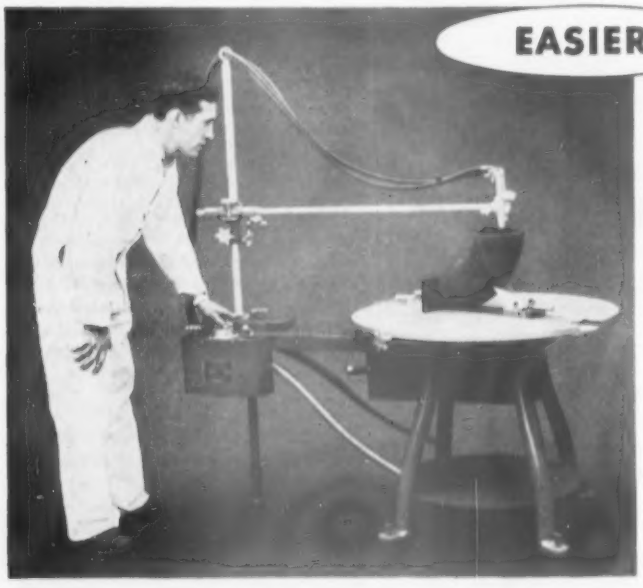
DISTINGUISHED salesmen show off trophies. From left to right are: (front row) Aaron Rupp, U. S. winner, Mrs. Rupp, Eutectic president, Rene D. Wasserman, Mrs. Desarzens and Andre Desarzens, winner from Canada. Others are: (back row) James P. Coughlin, J. E. Jackson, Thomas F. Fleming, and Fred F. Roehll, all of Eutectic.

DSA award to Eutectic salesmen

Recent recipients of the Victor trophy for distinguished selling were Aaron Rupp (for the United States) and Andre Desarzens (for Canada), both district engineers of Eutectic Welding Alloys Corp., Flushing, N. Y. The trophies were presented at evening ceremonies conducted by the National Sales Executives Club, sponsors of the awards, on Friday, March 2, at the Waldorf-Astoria Hotel, New York City.

The Distinguished Salesman's award is given in recognition of outstanding service to industry in a sales capacity. Aaron Rupp and Andre Desarzens were selected from other Eutectic representatives in the United States and Canada. They were chosen on the basis of doing the best day-in and day-out job of demonstrating new procedures to weldors, introducing new rods and electrodes and providing practical answers.



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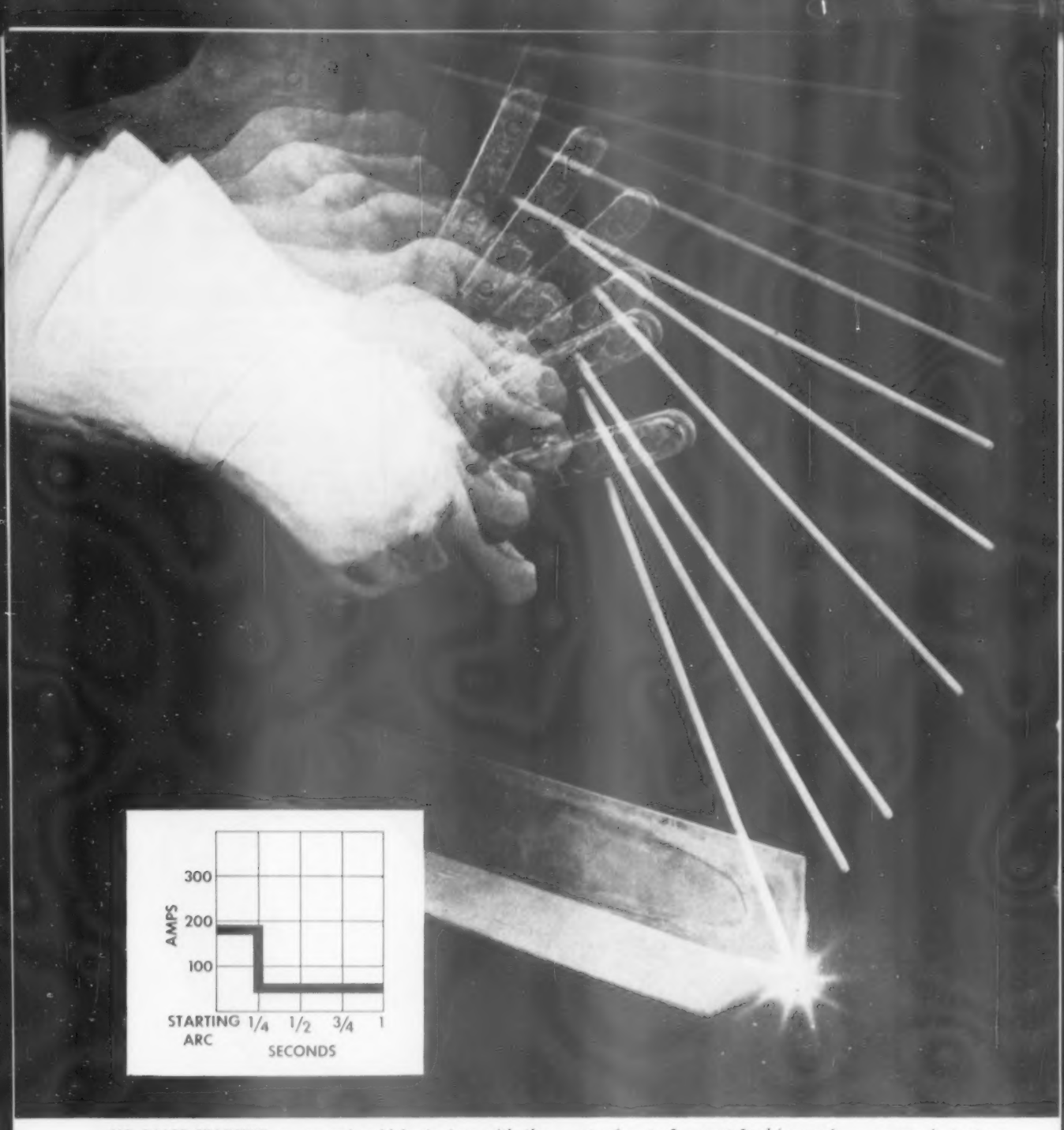

NO FALSE STARTING, no ragged weld beginnings with the G-E a-c welder's hot-start. Automatic G-E hot-start gives an extra boost of current for ¼ second . . . assures instant arc striking and extra penetration at the start of the weld.

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G.E. offers all popular forms of arc welders—plus a complete line of electrodes and accessories. This means that G.E. can recommend the equipment best for your job, without favoring any one type.

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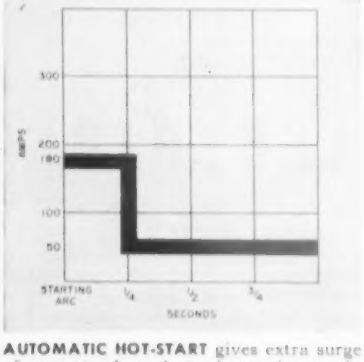
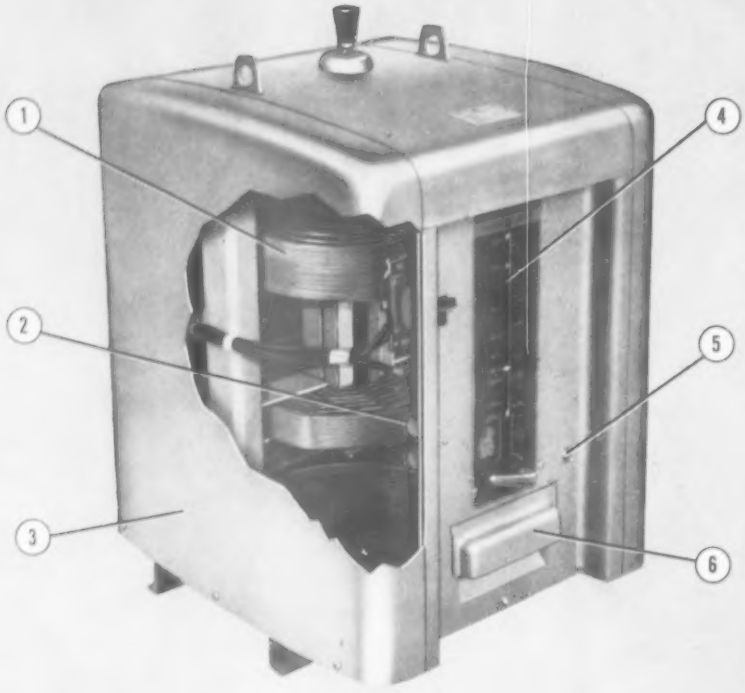
WELDING ARCS NEWS

25 TO 295 AMPS are spanned by extra-wide current range, which permits a wide number of varied applications. Low end of the range is expanded for greater accuracy.

SIDE COVERS LIFT OFF easily, with removal of just 3 screws. Maintenance is easy—no handles or primary leads to disconnect, no need to use cranes or hoists.



AUTOMATIC HOT-START gives extra surge of current when electrode touches work, reducing sticking, false starting. Welding is speeded, weld quality improved.



How G-E 295-amp AC Welders Provide Big-welder Benefits At a Small Welder Price

General Electric's 295-amp a-c welder is designed for light-duty, general purpose welding—but offers design features ordinarily found only in more expensive, heavy-duty welders. For example:

1 MOVING-COIL DESIGN provides pinpoint accuracy in current settings and resettings. Settings can be made in an infinite number of steps over a wide current range.

2 ARC STABILIZERS—two arc stabilizing capacitors provide the equivalent of 5 open-circuit volts, to make the normally steady a-c arc even steadier.*

3 REMOVABLE SIDE COVERS come off with removal of just three screws. Routine maintenance and inspection are greatly simplified.

4 WIDE CURRENT RANGE spans 25 to 295 amps. Expanded lower end of range permits extremely accurate settings.

5 AUTOMATIC HOT-START assures instant arc striking by providing an extra surge of current on electrode contact. In addition, hot-start furnishes extra penetration at start of weld, reducing "sticking".*

6 UNIVERSAL BOLT-TYPE TERMINALS located at the base eliminate the nuisance and hazards of dangling leads.

For more information, contact your nearby G-E Welding Distributor (he's listed in the yellow pages of your phone book)—or write Section 712-2, General Electric Company, Schenectady, N. Y. for bulletin GEC-1305.

*Improved arc-performance features, available optionally.

Progress Is Our Most Important Product

GENERAL ELECTRIC

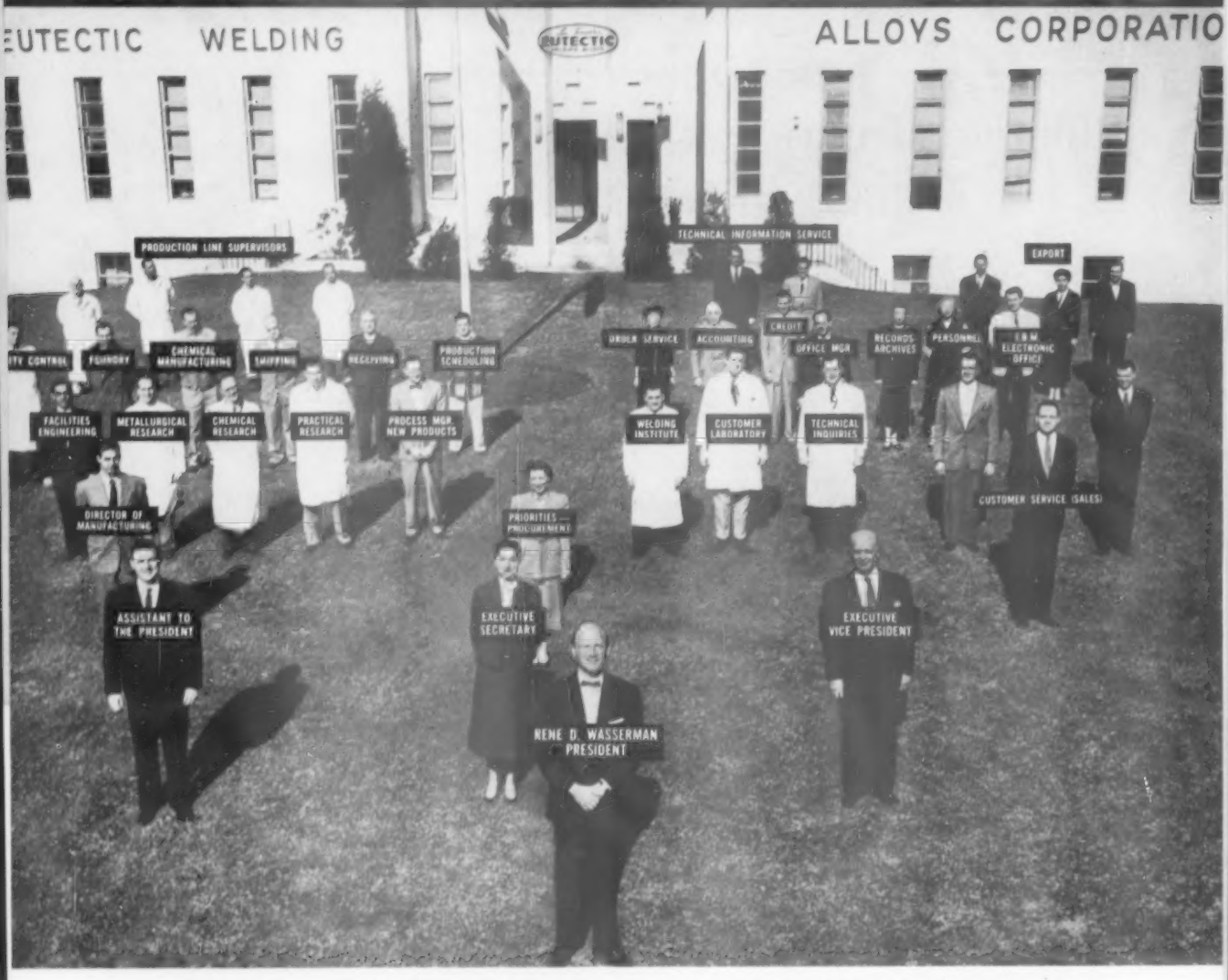
Relative strength and stiffness in bending structural metals

(Rectangular beams of constant width using SAE 1025 steel and minimum yield strengths as comparison basis.)

COMPARISON	MATERIAL	FORM	THICKNESS	STRENGTH	STIFFNESS	WEIGHT
EQUAL THICKNESS	SAE 1025 Steel		100	100	100	100
	SAE 4130 Steel	Heat Tr. Sht.	100	375	100	100
	Alum. 3003-½H	½ Hard Sht.	100	44	35	35
	6061-T4	Heat Tr. Sht.	100	44	35	35
	2024-T4	Heat Tr. Shapes	100	111	35	35
	7075-T6	Heat Tr. Sht.	100	183	35	35
	Titanium A-55	Sheet & Bars	100	140	52	57
	C110M	Sheet & Bars	100	275	52	57
	Mag. AZ31-O	Annealed Sht.	100	43	22	23
	AZ31-H24	H. R. Sheet	100	73	22	23
	AZ31	Extruded Bar	100	50	22	23
	ZK60A	Extr. & Aged	100	82	22	23
	AZ80-T6	Ht. Tr. & Aged	100	88	22	23
EQUAL STRENGTH	SAE 1025 Steel		100	100	100	100
	SAE 4130 Steel	Heat Tr. Sht.	52	100	14	52
	Alum. 3003-½H	½ Hard Sht.	150	100	120	52
	6061-T4	Heat Tr. Sht.	150	100	120	52
	2024-T4	Heat Tr. Shapes	95	100	30	33
	7075-T6	Heat Tr. Sht.	74	100	14	26
	Titanium A-55	Sheet & Bars	85	100	33	48
	C110M	Sheet & Bars	60	100	12	34
	Mag. AZ31-O	Annealed Sht.	152	100	79	35
	AZ31-H24	H. R. Sheet	117	100	36	27
	AZ31	Extruded Bar	142	100	64	33
	ZK60A	Extr. & Aged	110	100	30	25
	AZ80-T6	Ht. Tr. & Aged	107	100	27	25
EQUAL STIFFNESS	SAE 1025 Steel		100	100	100	100
	SAE 4130 Steel	Heat Tr. Sht.	100	375	100	100
	Alum. 3003-½H	½ Hard Sht.	141	88	100	49
	6061-T4	Heat Tr. Sht.	141	88	100	49
	2024-T4	Heat Tr. Shapes	141	221	100	49
	7075-T6	Heat Tr. Sht.	141	364	100	49
	Titanium A-55	Sheet & Bars	125	215	100	71
	C110M	Sheet & Bars	125	430	100	71
	Mag. AZ31-O	Annealed Sht.	165	117	100	38
	AZ31-H24	H. R. Sheet	165	200	100	38
	AZ31	Extruded Bar	165	136	100	38
	ZK60A	Extr. & Aged	165	222	100	38
	AZ80-T6	Ht. Tr. & Aged	165	238	100	38
EQUAL WEIGHT	SAE 1025 Steel		100	100	100	100
	SAE 4130 Steel	Heat Tr. Sht.	100	375	100	100
	Alum. 3003-½H	½ Hard Sht.	285	358	819	100
	6061-T4	Heat Tr. Sht.	285	358	819	100
	2024-T4	Heat Tr. Shapes	285	904	819	100
	7075-T6	Heat Tr. Sht.	285	1490	819	100
	Titanium A-55	Sheet & Bars	175	420	290	100
	C110M	Sheet & Bars	175	840	290	100
	Mag. AZ31-O	Annealed Sht.	439	831	1890	100
	AZ31-H24	H. R. Sheet	439	1429	1890	100
	AZ31	Extruded Bar	439	965	1890	100
	ZK60A	Extr. & Aged	439	1580	1890	100
	AZ80-T6	Ht. Tr. & Aged	439	1700	1890	100

—Courtesy Brooks & Perkins, Inc.

FOR YOUR TOUGHEST WELDING PROBLEMS



650 EUTECTIC PERSONNEL PROVIDE REAL WELDING HELP

The people in the photo above supervise several hundred metallurgists, chemists, engineers, production and customer service personnel at Eutectic's Flushing, New York plant, research laboratories, and administration building. Through Eutectic's District Engineers and Authorized Representatives, they provide you with the latest technical information on metal joining, and the most advanced welding alloys.

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Buffalo, N. Y.	Mohawk 8170
Cedar Rapids, Ia.	3-0255
CHICAGO, ILL.	**Regent 1-2424**
Cincinnati, Ohio	Main 8404
Cleveland, Ohio	PR. 1-1993
Columbus, Ohio	Capital 8-1664
Dallas, Texas	Ra. 7544
Denver, Colo.	Ke. 5151
Detroit, Mich.	Woodward 3-7245
Evansville, Ind.	5-6992
Flushing, N. Y.	Flushing 8-4000
Gastonia, N. C.	5-3466
Houston, Texas	Fairfax 3-0637
Hutchinson, Kans.	Mo. 5-8581
Indianapolis, Ind.	Market 3326
Kansas City, Mo.	Victor 4248
Little Rock, Ark.	Franklin 5-6909
Los Angeles, Cal.	Atlantic 4-2435 (San Gabriel)
Los Angeles, Cal.	Bradshaw 2-3181, Arizona 7-1234
Louisville, Ky.	Jackson 6673, 8449
Memphis, Tenn.	Ja. 5-1484
Moline, Ill.	E. Moline 3-8070
MONTREAL, QUEBEC	**Raymond 1-3339**
Nashville, Tenn.	4-1671
Newark, N. J.	Market 4-3242
Oakland, Cal.	En. 1-0053
Omaha, Neb.	Walnut 5663
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Paducah, Ky.	3-3606
Philadelphia, Pa.	Rittenhouse 6-1818
Pittsburgh, Pa.	Grant 1-9522
Portland, Ore.	Capital 3-6393
Reading, Pa.	Reading 4-3904
St. Louis, Mo.	Taylor 15508 (Kirkwood)
Salt Lake City, Utah	9-8731
San Francisco, Cal.	Douglas 2-7485
Syracuse, N. Y.	Syracuse 54-3595 (Liverpool)
Toronto, Ont.	Empire 8-1343
Tulsa, Okla.	Riverside 2-4783
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EUTECTIC
WELDING ALLOYS CORP.
40-40 172nd Steet, Flushing 58, N. Y.
Flushing 8-4000

—*Photos courtesy Linde Air Products Co.*

SEAM is Tig welded on a "Y" section of aluminum duct that will be used for fume and dust collection in a metal producing plant.

Tig welded aluminum ducts

EXTRA-wide plate for a 6-ft-diameter duct is produced by Tig welding a piece to the side of a standard plate. Heavy bar and angle hold pieces flat and absorb heat during welding.

A LARGE Texas plant is now installing aluminum ducts to replace sheet steel ducts formerly used for its pot line. All preliminary work, fabrication and erection is being done by Overly Manufacturing Co. of Greensburg, Pa.

Tig (tungsten inert-gas) welding, using argon as a shield, is used extensively in the fabrication of parts. Ducts range in size from several inches to 6½ ft in diameter. Smaller ducts, up to 3 ft in diameter, and all hangers and brackets are completed in Greensburg.

It is not economical to ship completed ducts in sizes much larger than 3 ft in diameter. For these, the plate is cut and welded where necessary to produce pieces of the correct size and shape.

It is then shipped flat to the plant. There, prepared pieces are rolled over forms and welded into larger sections as needed for installation in the plant.

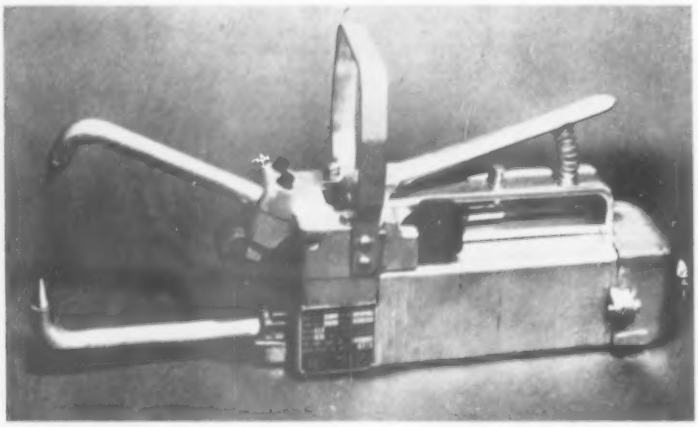
Aluminum ducts offer several advantages over steel. They weigh only about one-half as much as steel. Therefore, they are easier to install and need fewer supports.

Since aluminum does not rust, it does not need painting—a costly and tedious item of maintenance. Aluminum, due to its tough oxide surface film, is also somewhat more resistant to corrosive fumes than steel.

These advantages will pay off in longer service life and elimination of maintenance work.

new products . . . . . USE CARD ON PAGE 97

PLATE clamp has high holding power and is readily movable.



PORTABLE spot welder operates by squeezing handle. Can be converted to stationary unit.

Weldor's clamp

PLATE clamp has direct lift-off strength of over 3 tons. An electro magnet, 9 in. in diameter, supplies power. "BUX PC-6" is portable. It weighs 80 lb. overall. Model has an instant release which allows it to be moved immediately upon completion of weld.

Use of this clamp is said to cut down pre-welding time in making lap or butt welds and in straightening warped steel strips or plates. Because of its power, clamp will hold fast to rusty or dirty plates, states manufacturer. *Buck Mfg. Co.*

Circle No. 1.

Welding wire

AUTOMATIC buildup wire is for use with submerged-arc process. Deposits are claimed sound with good ductility. Wire is designed for use prior to final hardfacing on parts such as tractor rollers, earth moving shovel parts, cable drums. It also is for use as buildup with no hardfacing.

Wire responds to heat treatment and can be applied to most steels. It is said to have high impact strength and good wear resistance. *Air Reduction Sales Co.*

Circle No. 2.

Temperature indicator

RATING of new "Tempil" pellet is 100 F. Pellet can be used for variety of applications. Shipment of low-temperature indicator will be limited to off-summer months. If stored during hot weather, it must be kept under mild refrigeration.

Temperature indicators now available in 73 regularly spaced temperature ratings, ranging from 100 to 2,500 F. *Tempil Corp.*

Circle No. 3.

Spot timer

SYNCHRONOUS spot timer is for a-c use. It is available as single or dual unit. Timer incorporates delay firing to provide heat control over range of 20-100%. Timing range is 1 to 10 cycles, adjustable in 1-cycle steps.

Dual timer is used with one contactor and one transformer. It gives two separate, independent time settings and two independent heat settings. Dual or separate welding heads may be used with this unit. *Raytheon Mfg. Co.*

Circle No. 4.

Arc cutting

MACHINE is designed as power source for carbon arc-compressed air method of cutting and gouging of metals. "Carbonaire" is rated at 1,000 amp, 85% duty cycle; or 900 amp, 100% duty cycle, 36 to 54 volts.

Main current ranges are provided by four bus-type cable terminals, one negative and three positive. Cutting-torch cable is attached to low, medium or high current to suit job. Hand wheel adjusts arc voltage. Toggle switch allows soft start arc. Unit operates on two or three phase, 60 cycle, 220/440 volts (dual) or 550 volts (single); also on d-c. *Hobart Bros. Co.*

Circle No. 5.

Spot welder

PORTABLE "Greyhound" spot welder is for variety of applications. Welder operates by placing metal between welding tips and squeezing handle. This applies pressure to welding tips; additional squeeze turns on current. Pressure release shuts off current when fusion is made.

Welder may be converted to stationary unit by placing on stand. Pressure is then applied through foot pedal. Model "SP" welds mild or stainless steel to $\frac{1}{8}$ in.; galvanized to two pieces of 18 gage. Model "BW" welds mild or stainless steel to $\frac{1}{4}$ in.; galvanized to 2 pieces of 16 gage. *Duro-Dyne Corp.*

Circle No. 6.

Electrode-force gage

DETECTION of changes in force between electrodes of resistance welding machines is purpose of force gage. Measurements are made on recording oscillograph. Unit is strain-gage type, mounted on cantilever beam of non-magnetic materials.

One end attaches to horn of lower arm, other end mounts on front of machine base plate. Force is transmitted to assembly by deflection of lower arm. Beam can be adjusted to machines with throat depths from 12 to 60 in. by a three-section telescopic tube arrangement. Unit may be mounted on spot or seam welders. Measurements can be made during actual welding. *Sciaky Bros., Inc.*

Circle No. 7.

4th ANNUAL
WELDING SHOW
BUFFALO MEMORIAL AUDITORIUM
MAY 9, 10, 11

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WELDING SHOW

see the latest developments in Alcoa® Filler Metals and Fluxes for welding, brazing, soldering.

ALCOA—BOOTHS 64 & 65

New improved straight-length Alcoa Welding Rods.
Additional Alcoa alloys in spooled IG* electrodes.
Convenient new Alcoa packages . . . and many other new developments.
See you at Buffalo next month.

* Inert Gas

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L-T* Brazing steel saves money

UNITED **SIL-BOND** assures *Quality*

If you are a cost-conscious manufacturer, you should know:

Brazing cuts steps, saves time, assures a better looking, longer lasting steel joint.

If assured quality as well as cost counts with you, you should know:

United SIL-BOND works fast, flows neatly, brazes a smooth, clear, strong, highly ductile joint that never requires grinding or finishing.

Before designing for expensive machine hours, consider L-T* Brazing of low-cost stampings and screw machine parts.

*Low Temperature

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MEMORIAL AUDITORIUM

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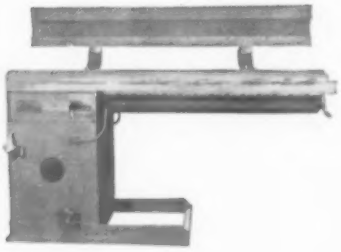

Automatic welder

FOR use with either inert-gas or submerged-arc welding head, longitudinal seam welder is termed series "G". Welder is primarily for light-gage welding of stainless and aluminum alloys. Welding head is optional.

Circular lower horn of welder allows welding of small diameters. Copper back-up bar is water-cooled. Upper horn is double-acting type; permits clamping of either side by foot-operated air valve. Six models range in capacity from 24 in. by 10 gage to 84 in. by 14 gage. *The Webb Corp.*

Circle No. 8.

Degreasing machine

CLEANING of small parts is function of "MSS-321 Vibra" degreaser. Unit moves small parts and chips in corkscrew motion, passing them through a liquid immersion, rinse and solvent vapor zone. Cleaned parts are emitted through an unload chute.

Oil, grease, dirt, etc, is removed by vapors condensing on parts. Degreaser is claimed to clean up to 3,000 lb per hour. It is made of steel plate reinforced with all-welded structural steel. Solvent capacity is 85 gal; shipping weight is 4,500 lb. *Manufacturers Processing Co.*

Circle No. 9.

Flux screen

VIBRATING flux screen is designed to screen flux for automatic submerged-arc welders. Unit separates scrap and fused flux from the usable flux. The usable flux is then discharged into boot of a bucket elevator and returned to welder.

Flux screen has balanced mechanical action which concentrates vibration on screen deck. It is claimed to transmit little or no vibration to welder. Screen is quiet-running and requires little upkeep, states manufacturer. Units are available in sizes 10 by 30 in. and 10 by 50 in. *Simplicity Engineering Co.*

Circle No. 10.

For more information use card on page 97

AUTOMATIC

TORCHES

THE HEART OF ECONOMY

Approved by Underwriters' Laboratories

BY ACTUAL COMPARISON

USING NON-AUTOMATIC TORCH . . . . . 12 Pieces Welded
USING NON-AUTOMATIC WITH GAS SAVER . . 18 Pieces Welded
USING HARRIS AUTOMATIC TORCH . . . . 28 Pieces Welded

Using the same amount of Oxygen and Acetylene for each set-up, this "Actual Comparison" Demonstration proved the Harris Automatic Torch to be a profitable investment for economical and efficient welding work.

Let our local Distributor show you the "Actual Comparison" test in your plant and explain quickly and simply why the Harris Automatic has the greater piece production at the lowest cost.

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Harris is the originator of the "Automatic" Torch and with almost 50 years of building "Know-How" behind every torch, the buyers and users get tremendous returns on their torch investment.

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SERVING THE METAL INDUSTRY SINCE 1905

AIRCOMATIC® welding wires

Pure...properly cast...level wound

Properly cast and carefully wound Aircomatic Welding Wires for use with the Aircomatic and Heliwelding processes are your assurance of reliable current pickup and smooth, uninterrupted wire feeding. All Aircomatic wires meet rigidly controlled specifications as to chemical analysis, surface finish, cleanliness and packaging, and are available in the widest variety of wire types and diameters.

Aircomatic Aluminum Welding Wires. Supplied on 10 lb. expendable spools . . . New Type A finish or a special Type C finish available . . . use Type C finish wire for all high-quality work where X-ray standards must be maintained . . . scrupulously clean . . . uniform surface treatment assures superior weld quality. New Type A finish meets high quality requirements . . . bright finish . . . properly wound . . . smooth surface assures trouble-free feeding.

Aircomatic Stainless Steel Welding Wires. Supplied on 25 lb. expendable spools . . . excellent corrosion resistance . . . good tensile, ductility and impact properties . . . use to weld ordinary joints, apply stainless linings, build-up stainless overlays and join stainless clad materials.

Aircomatic Nickel Base Welding Wires are available in types to weld commercially pure nickel, Monel and Inconel. These metals can also be overlaid on mild steel or other materials . . . nickel wires supplied on 25 lb. expendable spools.

Aircomatic Copper and Copper Base Alloy Welding Wires. Use to assemble copper bus bars . . . fabricate copper or bronze vats . . . build-up worn propellers, piston and valve parts . . . supplied on 25 lb. expendable spools in both solid and stranded grades.

Aircomatic Steel Welding Wires. Three grades available for welding mild steel, armor plate and for overlays and welding hardenable steels . . . supplied on expendable spools, chip board cores, coils or Wirepaks.

If any technical or metallurgical information is needed, it will pay you to consult your nearest Airco Representative.

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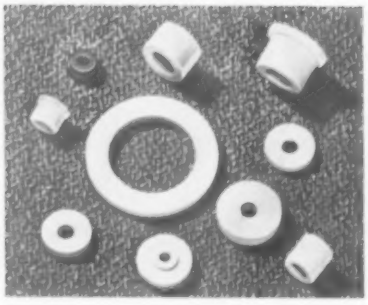


Ceramic preforms

PREFORMS for small parts welding at 400 F possess extremely high bonding strength with no shrinkage, states manufacturer. Formula "800," extracted from epoxy resins, is useful in joining metals to nonmetals and nonmetals to nonmetals.

Where low-heat joining is desired, formula "800" is claimed easy and fast. Preforms can be supplied in wide variety of shapes. *Mansol Ceramics.*

Circle No. 11.

Electrode

POWDERED-metal, low-hydrogen electrode is claimed fast in lineal speed. Designated "Strikeasy LH-2," the electrode is said to have high deposition rate, reduced slag cleaning time and low spatter loss.

Recommended for use with d-c reverse polarity, it can also be used on a-c. Ultimate tensile strength, as welded, is rated at 80-83,000 psi, yield strength at 70-73,000 psi, with elongation of 34% in 2 in. *General Electric Co.*

Circle No. 12.

Induction heating

LINE of induction-heating equipment has been expanded to include 960, 3,000 and 10,000 cycle low-frequency motor-generator units. Available in sizes from 30 to 1,250 kw, new units are suited to brazing, case hardening and heating. *Allis-Chalmers Mfg. Co.*

Circle No. 13.

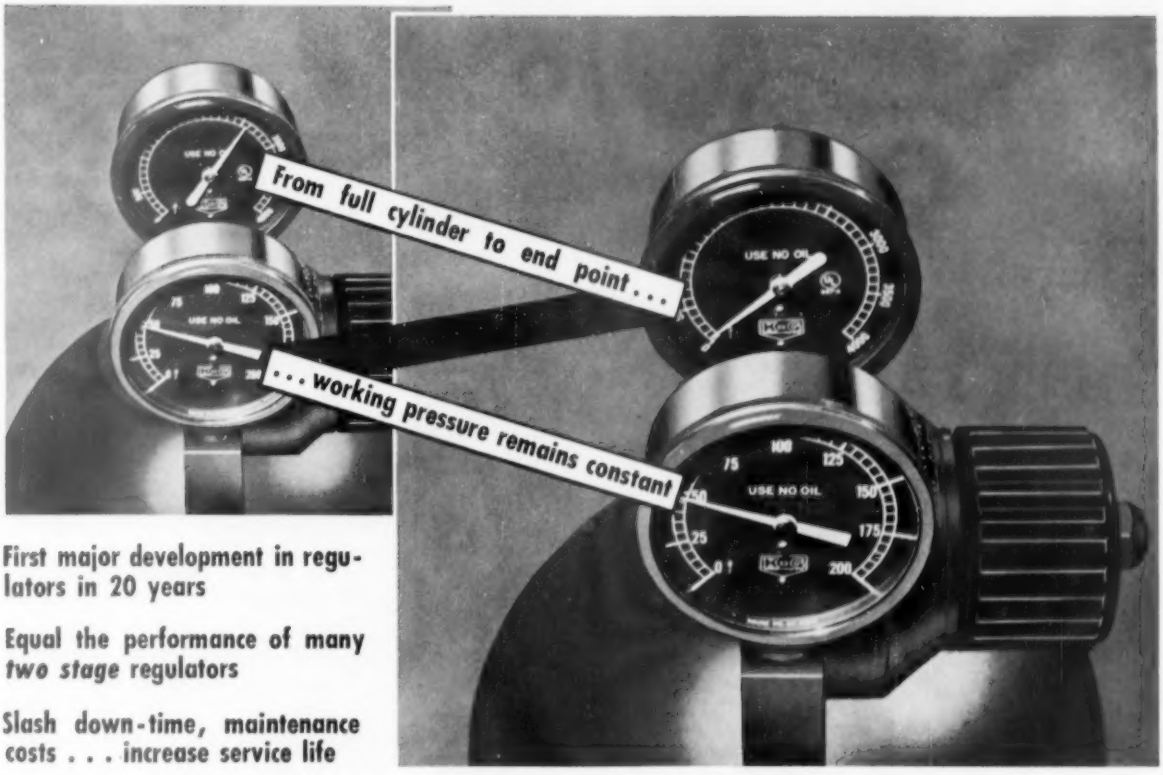
Grit blaster

ABRASIVE cleaning tool can be used inside tanks, on ceilings, floors, and before and after welding. It is lightweight, self-contained.

Termed "Educt-O-Matic," unit has swivel blast head, allowing blasting in all directions. It operates on air pressure. Dust is removed into attached bag, allowing abrasive to re-enter hopper for re-use. Tool operates on 33-60 cfm air supply. *Clementina Ltd.*

Circle No. 14.

New K-G Single Stage Regulators Out-perform All Others



First major development in regulators in 20 years

Equal the performance of many *two stage* regulators

Slash down-time, maintenance costs . . . increase service life

Get jobs done better, faster . . . virtually eliminate pressure readjustment. The new K-G Single Stage Regulators equal the performance of many two stage regulators—yet cost no more than many standard single stage models.

This superior performance—plus longer life and faster, easier maintenance—are the result of an entirely new, simplified design:

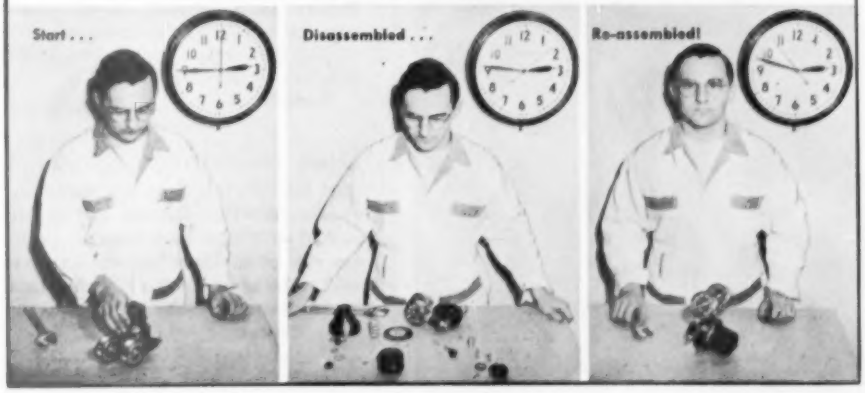
Bodies and bonnets are anodized aluminum alloy forgings . . . are stronger, lighter, more resistant to corrosion. The large-size diaphragm greatly increases sensitivity . . . a new stainless steel sintered metal filter practically eliminates seat failure . . . the adjusting mechanism rides on ball bearings for smooth, accurate control—is *fully enclosed* for complete protection against damage or loss.

The new single stage models—1200 Series—are available for practically all compressed gases, as are the new companion-product two stage models—1100 Series (for the ultimate in performance!). *The K-G Equipment Co., Inc., Dept. A., 1744 Lehigh St., Allentown, Pa.*

Ask Your K-G Distributor for a Demonstration—Send for New 24-page K-G Catalog

(Distributors: Valuable territories still open. Write for information!)

Take Apart, Re-assemble in 3 Minutes!



SEE OUR BOOTH 41

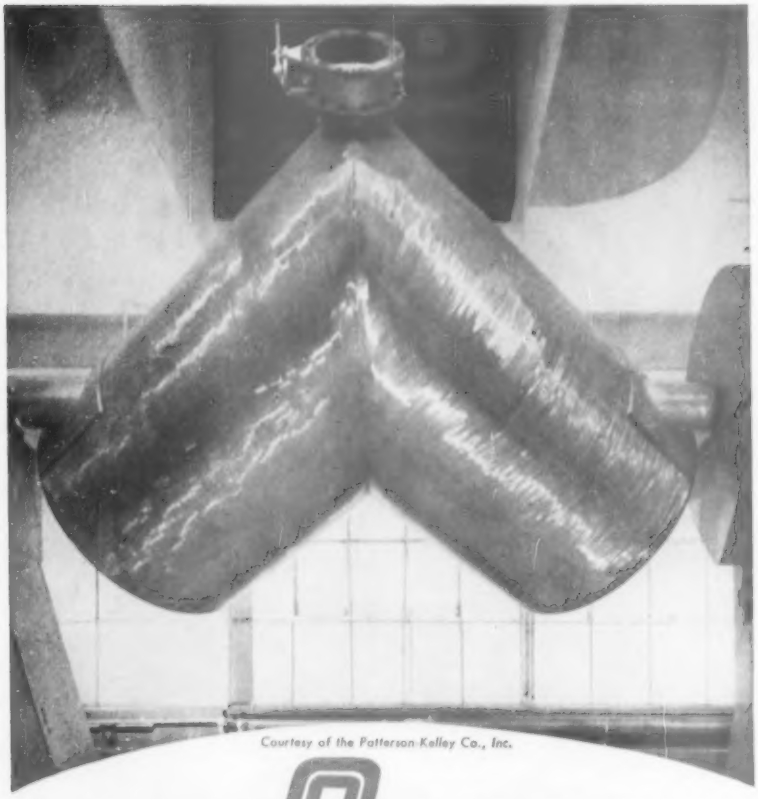
WELDING SHOW

MAY 9-11

MEMORIAL AUDITORIUM

BUFFALO, N. Y.

When contamination of products cannot be tolerated

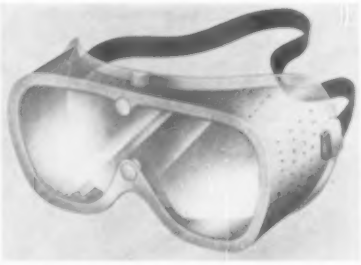


Courtesy of the Patterson-Kelley Co., Inc.

WELD WITH ARCOS

STAINLESS ELECTRODES

This precision blender is used for uniform mixing of vitamins and potent drugs with inactive materials where lack of uniformity or contamination would have serious results. The same high standard of performance is provided by the Arcos Electrodes used to weld the twin-cones. They provide smooth unbroken joints whose uniform *stainless* and sound mechanical properties are the result of conscientious quality control in their manufacture. When you want stainless welds with properties equal to the material being welded, specify Arcos Electrodes. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.



Safety goggles

SINGLE lens, "Soft Side" safety goggles are recommended for grinding, chipping. Plastic frame adapts readily to head, is available in crystal clear or green, states manufacturer.

Deep frame design gives clearance over prescription spectacles; fits snugly along temples. Single piece lens of impact resistant plastic is extra large, gives wide angle vision. Available in clear or green. Two snap fasteners provide quick lens replacement. Four ventilation styles: regular perforations; screened ports for extreme dust; baffled ports for acid and splash; no ventilation for vapor. *Welsh Mfg. Co.*

Circle No. 15.

Welders

CUSTOM automatic arc welders are claimed to give increased production. These special machines are designed to include any requirement, states manufacturer.

"T-W" automatic arc welders can use the Mig (metal inert-gas) process, Tig (tungsten inert-gas) process, submerged arc process and other welding processes. Welders may be used to weld variety of ferrous and non-ferrous metals. *The Taylor-Winfield Corp.*

Circle No. 16.

Welder-transformer

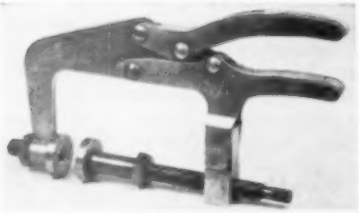
TRANSFORMER provides d-c power. Model "18A" (18 watt-seconds, lower limit) and model "1103" (8,100 watt-seconds) operate on stored energy principle. Transformer is rated at 1½ kva, 3 kva and 5 kva (50% duty cycle). *Raytheon Mfg. Co.*

Circle No. 17.

Dust collector

ALL new "FB" (bag-equipped) cyclone-type dust collectors will be furnished with after-filter bags of special Dacron cloth. These Dacron bags are said to be as effective a filter medium as standard wool and will not burn when exposed to continuous shower of sparks. *Torit Mfg. Co.*

Circle No. 18.



Toggle clamp

TOGGLE C clamp has locking feature for gripping work, with high holding power. Clamp is easily applied and may be released instantly, claims manufacturer. Adjustable spindle adapts clamp for operation.

Unit has brass movable jaw and gripping faces. Throat size is 4 by 2⅝ in.; overall length is 9⅜ in. Spindle is knurled on turning end for comfortable finger grip. *Robert J. Kelly Mfg. Co.*

Circle No. 19.

Automatic Mig welder

DESIGNED for Mig (metal inert-gas) welding, welder is 300-amp, constant-voltage type. Built-in rectifiers deliver current; operates on d-c. Arc voltage range is 16-42 volts; remains constant at pre-set value. This permits constant wire-feed rate, states manufacturer.

Input is 3-phase, 208-250 or 416-480 volts, a-c. Unit carries rating of 300-amp at 40 volts. Unit also has primary contactor, with remote control, series inductor and 15-amp, 120-volt accessory socket. Welder is 33 in. high by 21½ in. wide by 30 in. deep; net weight is 535 lb. *Glenn Co.*

Circle No. 20.

Flux

SOLDERING flux, non-corrosive, is for copper and copper alloys. "Hi-Grade No. 29" is said to decompose completely during soldering, leaving parts free of residues. Use of new flux is claimed to end washing and buffing after soldering to remove flux residues. *Hi-Grade Alloy Corp.*

Circle No. 21.

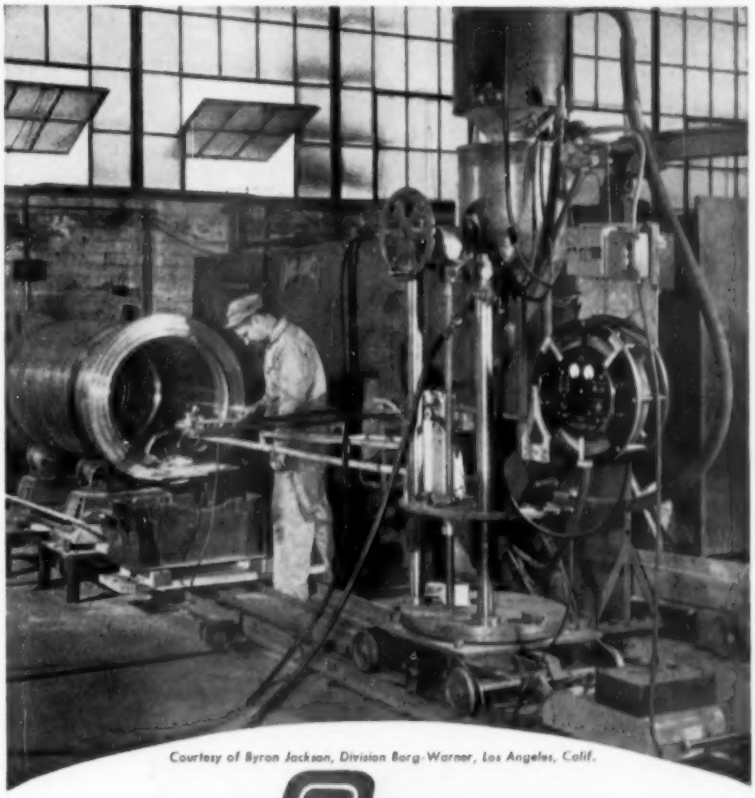
Safety hat

ALUMINUM safety hat is lightweight. Ribbed alloyed aluminum is said to insure maximum strength and toughness. Hat resists impact of 40 ft lb, will not crack or break when dropped, states manufacturer.

Waterproof hat has adjustable cradle. Hat is said to be cool and comfortable in hot weather. *Davis Emergency Equipment Co.*

Circle No. 22.

How to *guarantee* yourself the positive benefits of submerged arc welding

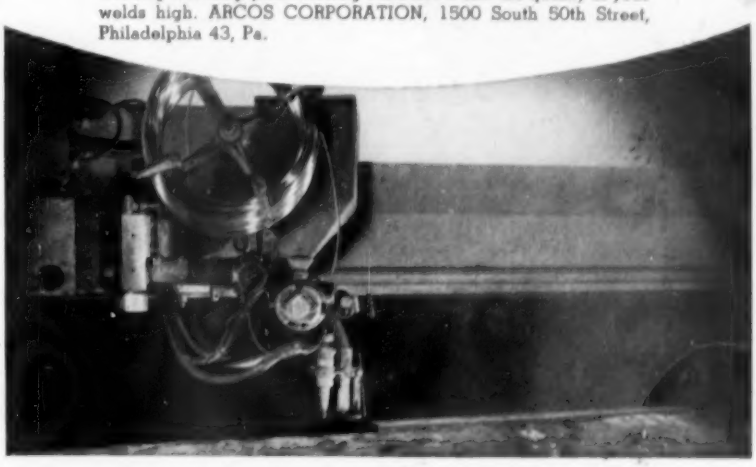


Courtesy of Byron Jackson, Division Borg-Warner, Los Angeles, Calif.

WELD WITH ARCOS

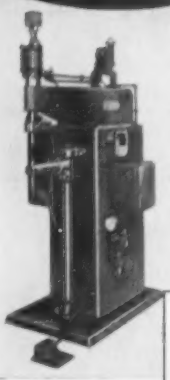
STAINLESS COILED WIRE

To save time and money, submerged arc welding was used to overlay type 308 stainless weld metal on the inside of this barrel of a boiler pump. Arcos Chromar Coiled Wire helped guarantee these savings through fast, easy deposition with minimum dilution. On your own jobs, Chromar Coiled Wire . . . *quality controlled* . . . teamed with the time-saving advantages of submerged arc welding will keep your welding costs down and the quality of your welds high. ARCOS CORPORATION, 1500 South 50th Street, Philadelphia 43, Pa.



Consult
EISLER

FOR
GENERAL
WELDING
EQUIPMENT



Eisler
Spot Welder
No. 250-VDAS

Eisler
Indexing Turntable
No. 88-GT-8

Eisler designs and manufactures spot welders from 1 KVA as well as a complete range of butt, saw and band welders and other welding equipment, including indexing turntables — standard, or to your order, electric or gas soldering and brazing machines.

Write today without obligation!

EISLER ENGINEERING CO., INC.
Charles Eisler Jr., President
749 SO. 13TH ST., NEWARK 3, N. J.

Tig torch cup

GLASS cup for "HW-17" Tig (tungsten inert-gas) welding torch is transparent. Cup eliminates blind spots, it is claimed, by allowing weldor to see puddle through, as well as below, the cup used to convey shielding gas to weld zone.

The "No. 7" glass cup and its ceramic adaptor are attached to the torch in the same manner as a conventional ceramic cup. *Linde Air Products Co.*

Circle No. 23.

Metal disintegrator

DISINTEGRATOR, known as "Model B-1," is said to quickly remove broken taps, drills, etc. Self-contained cabinet is wired for 110, 220 or 440 volts. Operation is fast without use of electronic tubes, rectifiers or condensers, manufacturer states. *Jiffy Disintegrators, Inc.*

Circle No. 24.

Flux paste

PACKAGING feature of all-purpose "Redi-Mix" solder-flux paste allows instant use. Available in plastic squeeze bottle, paste is ready to clean, flux and solder common metals, without need for separate flux and solder.

Solder-flux is combination of high-strength tin-lead solder and chemically active flux, suspended in agent that prevents hardening. Heat is applied to surface where paste is squeezed out until flux rises to surface, bubbles and turns dark. Available in ½- and 1-lb sizes. *Anchor Metal Co. Inc.*

Circle No. 25.

Selenium rectifier

VERSATILE sub-miniature selenium relay rectifier energizes d-c relay coils. Termed "Type 60-9267," it is a full-wave center-tap rectifier; may be used as half wave or back wave.

Rectifier is rated for 66 v maximum a-c input and will deliver 22 ma d-c as center tap or 11 ma as half wave. It measures 0.380 in. in diameter and 0.380 in. long. It is ideal for use as arc suppression rectifier or as bias supply for electronic equipment. *International Rectifier Corp.*

Circle No. 26.

For more information use card on page 97

NEW

Welder's magnetic plate clamp

POWERFUL — Direct lift off strength 6500 lbs.

PORTABLE — A compactly balanced, easily handled 80 lbs.

PROFITABLE — Saves up to 35 minutes per weld.

You BUX dealer is anxious to demonstrate this tool right on your job. He can show you in person how welders of heavy plate all over America are saving more than a half hour of preparation time on every weld they make.

Call your BUX dealer today. Or write for his name and for descriptive literature to Buck Mfg. Co., 106 Roberts Road, Los Gatos 5, California.

BUX magnetic products

MUREX® SPEEDEX HTS

TYPE E-7016

For all-position welding, of hard-to-weld steels

Low hydrogen–iron powder electrodes for low alloy, high tensile steels, MUREX SPEEDEX HTS electrodes deposit more pounds of weld metal per hour than conventional electrodes. They are preferred for a variety of hard-to-weld metals, where welding speed and strength are important and underbead cracking must be minimized or eliminated.

- SPEEDEX HTS gives a quiet, steady arc with good penetration.
- SPEEDEX HTS deposits are easily controlled . . . slag is light and friable.
- SPEEDEX HTS produces porosity-free welds that will readily pass radiographic inspection.

For further information on this or the complete line of Murex electrodes, machines and accessories, write or phone—there's an office near you.

See us at Booth 74 Buffalo, N. Y., May 9-11 WELDING SHOW

WELDING SUPPLIES
RADIOGRAPHIC EQUIPMENT
PLATING MATERIALS
ORGANIC COATINGS
CERAMIC MATERIALS
TIN & TIN CHEMICALS
METALS & ALLOYS
HEAVY MELTING SCRAP

METAL & THERMIT
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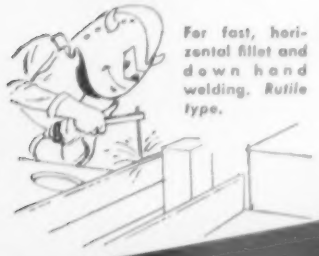
100 EAST 42nd STREET • NEW YORK 17, N. Y.

NO. 12



For fast, horizontal fillet and down hand welding. *Rutile type.*

NO. 14

For fast, all position welding. *Rutile type.*

For CHAMPION RESULTS
Choose these
IRON POWDER
SPEEDEMON
ELECTRODES

■ Champion Speedemon iron powder electrodes are carefully compounded to insure uniform quality weld deposits. These electrodes offer very high deposition rates with minimum spatter loss and extremely easy slag removal. They offer extreme ease of handling. *Full information is available upon letterhead request to Dept. W.*

NO. 716

For fast, high quality any position welds on hard to weld steels. *Low hydrogen type.*

NO. 716-MO

For fast, all position welding on 70,000 P.S.I. steels. Low hydrogen .5% *Moly type.*

See us at Booth 116 . . . A. W. S. WELDING SHOW
May 9th - 11th • Buffalo, New York

THE CHAMPION
RIVET COMPANY
CLEVELAND 5, OHIO EAST CHICAGO, INDIANA

NEW PRODUCT BRIEFS

Saw for cutting ferrous, non-ferrous metals and plastics is bayonet-type. Model "148" has orbital blade action. *Porter-Cable Machine Co.*
Circle No. 27.

Cam clamp said to have greater holding pressure uses interchangeable soft metal pads. Available in sizes from ¼ to ⅝ in. *Jergens Tool Specialty Co.*
Circle No. 28.

Permanent dry lubricant "Useco-Lube" is for application to metallic surfaces. It is said to reduce corrosion and friction. *U. S. Engineering Co.*
Circle No. 29.

Slide rule, made in green-yellow, coincides with optimum sight point, cutting eyestrain, blurring and errors in reading, it is claimed. Available in 6 and 10 in. trig, log-log standard rules or made to order. *Pickett & Eckel, Inc.*
Circle No. 30.

Vacuum cleaner "No. 65" is for industrial use. It is claimed to have good cleaning power; can be converted to blower. *The Black & Decker Mfg. Co.*
Circle No. 31.

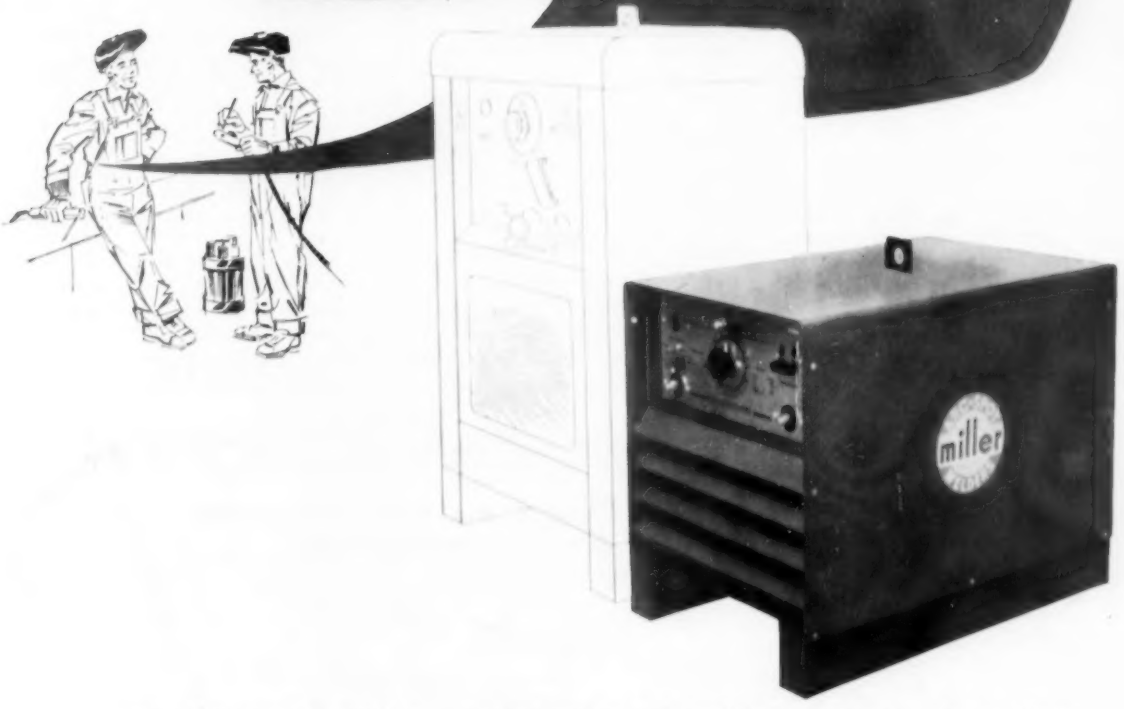
Electric impact wrench "No. 56" is for tapping, driving or removing studs (with attachment), nut-setting and removal. *Thor Power Tool Co.*
Circle No. 32.

Valve (two-way globe pilot-operated solenoid type) can operate at pressures from 10 to 3,000 psi, available in any voltage. Stainless steel valve is 1-in.—"HPSS" has high pull coil, "SS" has standard coil. *Atkomatic Valve Co., Inc.*
Circle No. 33.

CORRECTION

On page 82 of our March issue the new "Atom Arc 7016 Mo" electrode was termed "Atom Arc 7016." The "Atom Arc 7016" does *not* contain molybdenum while the "Atom Arc 7016 Mo" does.

say, see the new **miller** *SRH low-boy?*



Where floor space is a problem — or where stacking and paralleling is indicated — the new Miller SRH LOWBOY is the engineered-to-your-needs answer! This dc rectifier type welder is available in three models with 60% duty ratings of 200, 300 and 400 amperes. Combining compactness with quiet operation, minimum arc blow, top electrical efficiency and waterproof construction, the LOW-BOY is *another* Miller first that "figures."

Upright SR models to 600 amperes at 40 volts with 750 amperes maximum output; Duplex units up to 1200 amperes, 40 volts, 1500 amperes maximum.

". . . if it's MILLER you know it's the finest . . ."

New

MILLER ARCWELD welding electrodes are worthy of the MILLER name and reputation. Ask your distributor for some . . . you'll *like* the job they do.

BE SURE TO LOOK US UP
AT THE SHOW IN BUFFALO
BOOTH 566

miller

ELECTRIC MANUFACTURING CO., INC.
APPLETON, WISCONSIN

Distributed in Canada by
Canadian Liquid Air Co., Ltd.,
Montreal, P.Q.

NEWS . . . . . *from page 6*

a report on European welding.

Among topics to be covered will be discussion of weld-cracking tests on armor steels, gas-shielded welding, welded structures, nuclear reactor welding, welding of dissimilar metals, welding type 347 stainless steel, material and design concepts leading to higher welding stresses in pressure vessels, tests of welds and their value, and a discussion of brazing and soldering. Of particular interest will be the safety session which will give help in planning and executing safety programs and provide tips on best practices.

January RW sales reach new high

Statistics compiled for January by the Resistance Welder Manufacturers' Association, Philadelphia, indicate the current year will be excellent for the resistance welding industry.

New business for January showed an increase of nearly 186% over the same month last year. The $5,506,000 in net orders received during January is reportedly the greatest monthly figure in the association's history.

Minnesota Rubber builds new plant

Construction of a new plant addition has begun for Minnesota Rubber & Gasket Co., Minneapolis. This marks the fourth expansion in less than three years for the firm, manufacturer of such parts as seals, valve seats and specialized rubber products for the welding industry and metal trade.

When completed in July of this year, the three-story brick and concrete structure will increase floor space by 32,000 sq ft. The building will include production facilities, general offices and a testing laboratory.

Study finds aluminum corrosion resistant

Some aluminum alloys can resist corrosion in either a marine or inland atmosphere for at least 20 years. These results were obtained in a study conducted by the National Bureau of Standards, Washington, D. C. The study also explored affects of heat treatment and protective coatings on corrosion rates.

ASME sponsors Conference

A conference to study industry's problems in design engineering will be held at Convention Hall, Philadelphia, May 14-17. It will be held concurrently with the first Design Engineering Show.

On display at the show will be welding equipment, testing machines and X-ray machines, as well as basic finishes. (See Calendar, p. 84)

B & W Co. receives advertising award

The Atlas award, the marine industry's top advertising honor, has been presented to the boiler division of The Babcock & Wilcox Co., New York City. The award was given on the basis of a series of seven advertisements in 1955 devoted to the merchant marine service.

Tempilstik° FOR ALL HEAT-DEPENDENT OPERATIONS

looks like a crayon... marks like a crayon... tells temperatures like a precision instrument!

Available in these Temperatures (F.)

113	375	1000
125	388	1050
138	400	1100
150	413	1150
163	425	1200
175	438	1250
188	450	1300
200	463	1350
213	475	1400
225	488	1450
238	500	1500
250	550	1550
263	600	1600
275	650	1650
288	700	1700
300	750	1750
313	800	1800
325	850	1850
338	900	1900
350	950	1950
363		2000

Sixty-three different compositions enable you to determine and control working temperatures from 113° to 2000° F.

TEMPILSTIK° marks on workpiece "say when" by melting at stated temperatures — plus or minus 1%.

ALSO AVAILABLE IN LIQUID AND PELLET FORM . . . WRITE "WELDING SALES" DEPT. FOR SAMPLE TEMPIL° PELLETS . . . STATE TEMPERATURES OF INTEREST—PLEASE!

Visit us at Booth 207 — May 9-11 Welding Show — Buffalo, N. Y.

Tempil° CORPORATION 132 WEST 22ND STREET, NEW YORK 11, N. Y.

Visit us at Booth 207—May 9-11—Welding Show—Buffalo, N. Y.

Every HARRISBURG GAS CYLINDER has unusual life expectancy

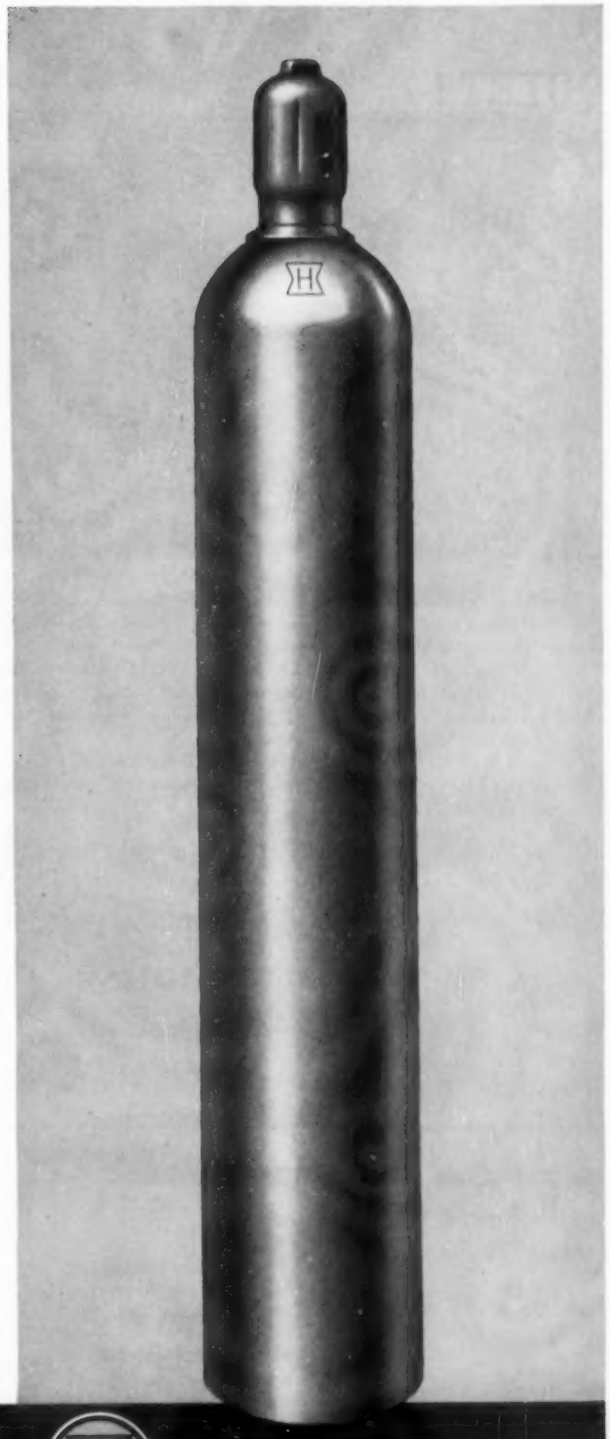
Buyers of gas cylinders generally consider two qualities especially important—lightness and durability. Harrisburg Cylinders are designed to obtain an optimum balance between these two advantages.

All Harrisburg Seamless Steel High Pressure Gas Cylinders are made as light *as is consistent with long life expectancy*. When you order Harrisburg Cylinders you can be sure that you are getting something far better than cylinders that just barely meet the specifications—we make them with an eye to passing future quinquennial tests.

If you want your money's worth, buy cylinders with a future—

-buy **HARRISBURG.**

Write for literature and prices.



More than a century in Harrisburg

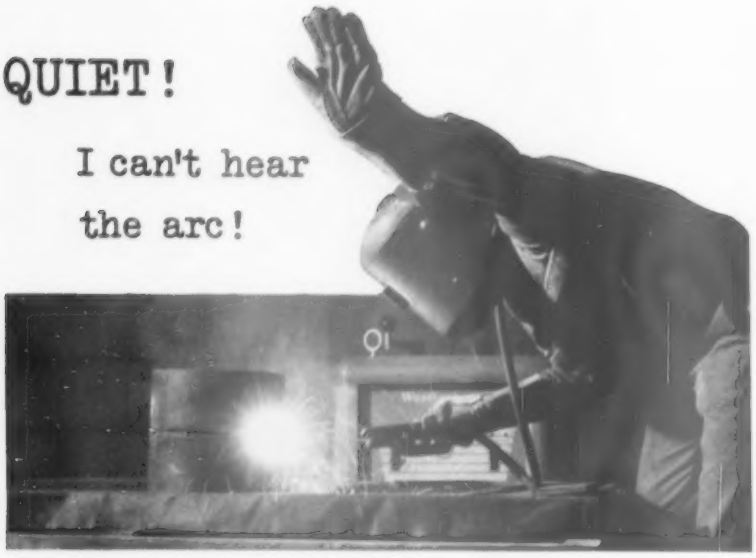
Harrisburg Steel

CORPORATION

HARRISBURG 8, PENNSYLVANIA

QUIET!

I can't hear the arc!



Good welders know a soft, quiet arc means that all the electrical energy is being spent pushing metal into a strong, sound seam. They know there will be less spatter loss, less cleaning time, lower welding cost per foot.

It is this quality of soft arc that distinguishes the Westinghouse XL-610 electrode. With it, welders get the kind of welds their *pride in workmanship* demands . . . production managers get the sound physicals and low cost their *product* demands.

If you haven't yet tried the Westinghouse XL-610—the soft-arc, easy-handling AWS E-6010 electrode—why don't you do so now. Fill in the attached coupon and mail it to us today. J-21952

Only Westinghouse offers this welding leadership!

YOU CAN BE SURE...IF IT'S

Westinghouse

WESTINGHOUSE ELECTRIC CORPORATION
Welding Dept., P. O. Box 868
Pittsburgh 30, Pennsylvania

☐ Send full information, samples
☐ Have welding specialist call

Name_____ Title_____

Company_____

Street & No._____

City_____ Zone___ State_____

Disabled vet proves asset

Disabled in World War II, Anthony Barre has proved a valued employee of All-State Welding Alloys Co., Inc., White Plains, N. Y.

Loss of a leg prevented him from returning to his occupation as a laborer at the end of the war. Unable to wear an artificial limb, Mr. Barre felt he was limited to the job of watchman.

Applying for work at All-State, Barre was placed in the shipping and receiving department. His handicap has failed to slow him. As an assembler he has already earned one promotion.

In the opinion of All-State vice-president Richard H. Mandel, Anthony Barre is a "valued man."

COMING EVENTS

APRIL 10-11: Machine Design Conference, American Society of Mechanical Engineers, Bancroft Hotel, Worcester, Mass.

APRIL 27-28: First Santa Clara Valley Welding Show and Clinic, Engineering Bldg., San Jose State College, San Jose, Calif.

MAY 8-11: Thirty-seventh Annual Meeting, American Welding Society, Hotel Statler, Buffalo.

MAY 9-11: Fourth Annual Welding Show, Memorial Auditorium, Buffalo.

MAY 14-17: Design Engineering Conference, American Society of Mechanical Engineers, concurrently with Design Engineering Show, Convention Hall, Philadelphia.

JUNE 27-29: Summer Meeting, Compressed Gas Association, Seaview Country Club, Absecon, N. J.

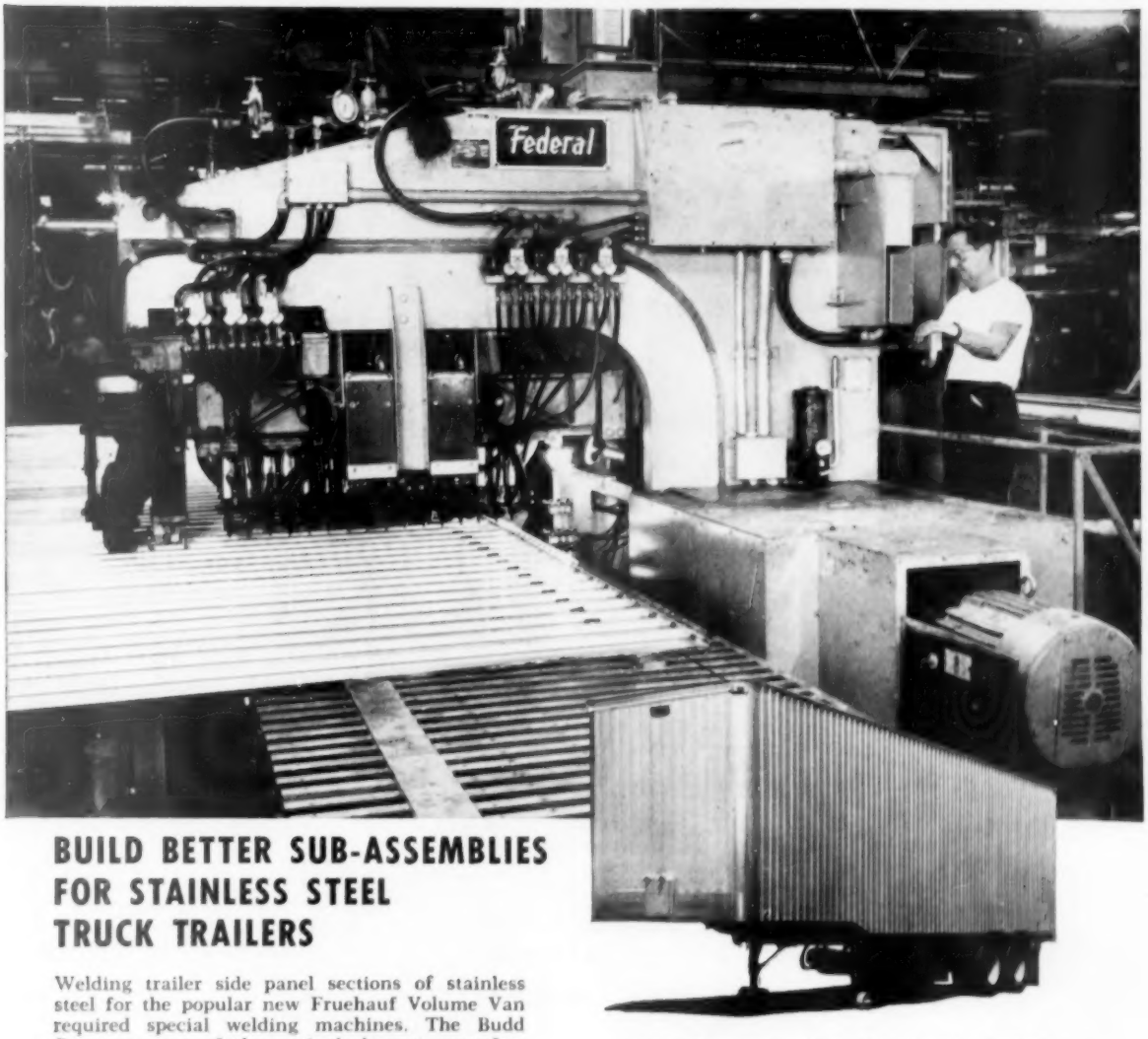
SEPT. 24-28: Trade Fair of Atomic Industry, Atomic Industrial Forum, Inc., Navy Pier, Chicago.

SEPT. 25-27: Third Annual Atomic Industrial Forum Conference, "Management & Technology for Atomic Industry," in conjunction with Trade Fair, Morrison Hotel, Chicago.

OCT. 8-12: National Fall Technical Meeting, American Welding Society, Cleveland.

OCT. 8-12: Thirty-eighth National Metal Exposition and Congress, Cleveland Public Auditorium, Cleveland.

How -Federal- Helps Budd...



BUILD BETTER SUB-ASSEMBLIES FOR STAINLESS STEEL TRUCK TRAILERS

Welding trailer side panel sections of stainless steel for the popular new Fruehauf Volume Van required special welding machines. The Budd Company, one of the nation's largest manufacturers of transportation equipment, naturally, turned first to Federal.

Federal, in cooperation with Budd, designed and built an ingenious "C" frame multi-spot traveling welder that turned the difficult job of welding side frame panels and structural skirt sections into a high production operation.

Self-propelled on 120 feet of rail, the machine travels over the work which is laid horizontally on a copper shunt die back-up fixture. It features an adjustable slow speed for indexing with a rapid traverse for return. Two rows of tandem piston, double-acting air guns are indexed at right angles to the line of welder travel to permit close spot welding. The machine automatically positions itself and selects gun sequence. Operator, riding with the machine, always has clear view of work, ready access to controls.

Stainless steel sub-assemblies for the Fruehauf Volume Van (above) are fabricated by the Budd Company for Fruehauf.

If your operation calls for special resistance welding — you, like leading manufacturers, should call on *Federal — First in Resistance Welding.*

WELDING SHOW
Booth No. 73

THE FEDERAL MACHINE AND WELDER COMPANY

WARREN, OHIO

-Federal- WELDERS

Warco PRESSES

9801

no matter how you weld it...

Gasweld

can serve you better

FREE CATALOGS
On the complete lines of Gas and Arc welding equipment. Also literature on the improved CO_2 TIG* and MAGS* methods of welding. Send for your free copies today.

Gas, Arc, CO_2 TIG* or MAGS* welding, whichever you use, you'll find LIQUID welding equipment that will meet your needs to perfection.

Ruggedly dependable, extremely easy to use, advanced in features and design... LIQUID leads the way in *all* welding equipment. Contact your nearby LIQUID welding equipment representative. He'll be happy to show you how this fine equipment can improve *your* operation.

*TIG—*Tungsten Inert Gas*
MAGS—*Metal Arc Gas Shielding*

BOOTH 93
WELDING SHOW

See a live demonstration of both TIG* and MAGS* welding.

THE **LIQUID** CARBONIC CORPORATION
3100 S. Kedzie Ave. • Chicago 23, Illinois

LIQUID ALSO PRODUCES Oxygen, Acetylene, and other commercial gases including CO_2 in all its forms for industrial use

M & T moves executive offices

Executive offices of Metal & Thermit Corp., New York City, have been moved to new quarters at 100 Park Ave., in that city.

NWSA welcomes new members

New active members of National Welding Supply Association are: Acme Welding Supply Co., Kansas City, Mo.; Alamo Welding Supply Co., Austin, Texas; Anderson Welding Supply Co., Aberdeen, S. Dak.; Central Welding Equipment Co., Ft. Smith, Ark.; Industrial Welding Supply Co., Mobile, Ala.; Magnolia Welding Supply Co., Pascagoula, Miss.; Putman Welding Service Inc., Ottumwa, Ia.; Valley Oxygen Co., Bay City, Mich.; Valley Supply Co., Ottumwa, Ia.

Engineers to confer at Ohio State

Problems facing the profession will be discussed at the Third Annual Conference for Engineers, May 4, in Columbus, Ohio. The conference is sponsored by the College of Engineering of Ohio State University.

Grinding is one of Man's oldest arts

Grinding is one of man's oldest arts. The caveman used natural abrasives to sharpen instruments of bone and horn 25,000 years ago, according to Electro Refractories & Abrasives Corp., Buffalo. Prehistoric man learned to grind and polish flint.

During the past 50 years modern grinding has developed its techniques. As harder metals and alloys are discovered impetus is given to finding harder and more efficient abrasives.

Distributor appointments

Alloy Rods Co., York, Pa.: Allied Welding Co., Shreveport, La.; Wilson Welding Supply Co., Cumberland, Md.; Edward Fields & Co., Morgantown, W. Va.

Carboloy Department, General Electric Co., Detroit: Central Supply Co. of Virginia Inc., Andover, Va.

Welding Department, General Electric Co., York, Pa.: Kirk-Wiklund & Co., Kansas City, Mo.; McJunkin Corp., Charleston, W. Va.

Miller Electric Mfg. Co., Inc., Appleton, Wis.: Nunn's Battery & Electric Co., Inc., Montgomery, Ala.; Sterling H. Dockson, Detroit.

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Spooled... layer wound to assure a smooth, even feed. Sizes: .035", .045", 1/16", 5/64" and 3/32" diameters.

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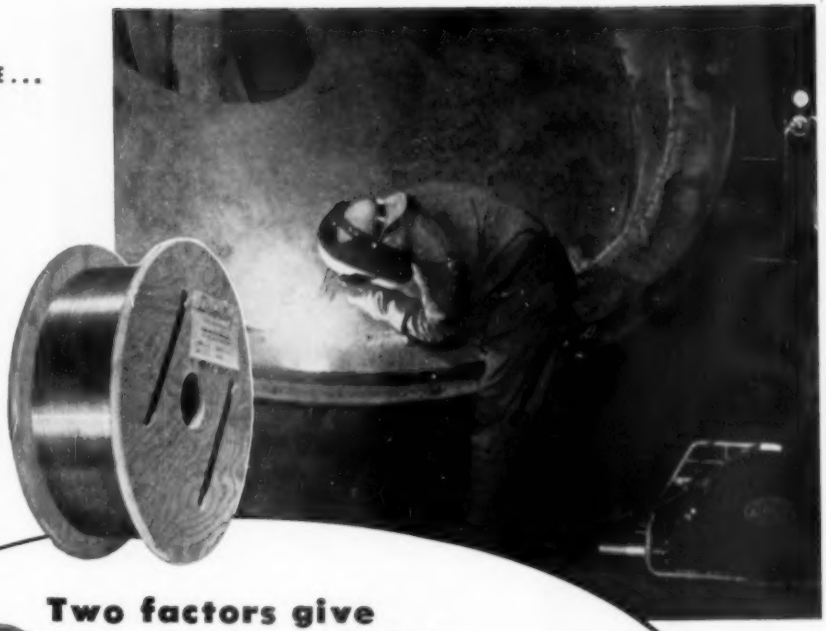

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A DIVISION OF AIR REDUCTION COMPANY, INCORPORATED

Henry D. Weed and *Richard I. Allen* have established business as manufacturer's representative. The new firm will sell and service, in the Detroit area, products of WW Alloys, Inc., division of Fansteel Metallurgical Corp., North Chicago, Ill. Mr. Weed and Mr. Allen were general manager and sales manager respectively of WW Alloys. To fill the vacancy, *Walter A. Cox* has been appointed general manager of WW Alloys, Inc. In addition, *Stuart C. Lawson* (Lawson Sales) has been selected as manufacturer's representative to cover Wisconsin, and the Rockford-Freeport area in Illinois for the WW Alloys products. Mr. Lawson was formerly general sales manager of Ampco Metal, Inc., Milwaukee. His headquarters are in Milwaukee.

G. A. Conner has been named chief inspector and welding engineer of Standard Steel Corp., Los Angeles. Standard is a designer and manufacturer of rotary dryers, heavy alloy plate products and asphalt plants. Mr. Conner, well known in Midwest and Pacific Northwest welding circles, will be responsible for quality control, preparation and development of welding procedures and testing. He is a member of the American Welding Society.

James N. Thompson has been named manager of the General Electric Co. welding department's newly created east central district. He joined the firm in 1947. He will headquarter at the new welding sales office and warehouse, 20810 Miles Ave., in Cleveland. *Hubert G. Hinkel* has been named supervisor of the new sales office and *William E. Cooper* has been appointed sales engineer for the new district.

The board of directors, Metal & Thermit Corp., New York City, has elected two new directors. They are *Cornelius W. Middleton* and *Lester C. Rogers.*

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for the 14th time

1956 **Welding Engineer** MID-JUNE

FACT FILE issue

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A **KASSON** PRODUCT

Virgil J. Hinchliffe was recently appointed district manager of the Washington, D. C., welder territory by Harnischfeger Corp., Milwaukee. This appointment is in addition to his previous appointments as district manager in Washington, D. C. He will continue to personally represent the firm in the Washington-Baltimore and Norfolk areas. Mr. Hinchliffe joined the firm in 1946; in 1949 he became welding engineer for the U. S. Bureau of Ships. He rejoined Harnischfeger three years later. He is a member of the American Welding Society. *Raymond O. Fish* is now associated with the P. & H. Welding division, located in Milwaukee.

Ralph R. Brown has been appointed works manager and *Ernst A. Siemssen* has been named superintendent of erection by Selas Corp. of America, Dresher, Pa.

Walter Kaiser has been appointed assistant chief engineer by Thomson Electric Welder Co., Lynn, Mass. He has wide experience in design and application of resistance welding equipment. He was previously development engineer for Progressive Welder Co., and most recently chief engineer at Multi-Hydromatic Welding & Mfg. Co.

A. B. Williams has been appointed sales manager of Virginia Welding Supply Co., Charleston, W. Va. The appointment was announced by *William A. Rice*, president of the firm.

Krist Leovich, Jr., has been appointed sales engineer for the West Coast sales office of Wall Colmonoy Corp., Detroit. He will be responsible for hardfacing products and application engineering. He will headquarter at West Coast offices, Montebello, Calif.

The following appointments have been made at the Henry Disston division, H. K Porter Co., Inc., New York City. *Louis W. Jander* has been named general sales manager succeeding *Walter H. Gebhart*, who is now a consultant on sales policies and trade relations. *John H. Dingee* has been named hardware sales manager and *John W. Vance*, works manager.

Robert J. Mason has been named manager of the Atlanta district by the Carboloy Department of General Electric Co., Detroit. He was previously carbide sales and service engineer in the Philadelphia area. He succeeds *E. R. Almdale*, who resigned. Mr. Mason will headquarter at the company's Newark, N. J., office. *Howard W. Arnold*, formerly a Chicago area sales representative for Carboloy, has been appointed manager of distributor sales. He will headquarter in Detroit.

M. Mark Watkins was elected a director of Walworth Co., New York City. Mr. Watkins is executive vice-president and a director of Conoflow Corp., Philadelphia, a manufacturer of pneumatic automatic valve control equipment.

Two promotions have been made in the Los Angeles office of Harnischfeger Corp., Milwaukee. *William G. Godfrey* has been named district manager, construction and mining division, with supervision of welding division sales. *Oscar E. Sandstrom* has been named district manager, industrial division.

Dan H. Nordstrom has been appointed sales representative in Texas, Oklahoma and Louisiana by Heath Engineering Co., Fort Collins, Colo.

Four changes in territorial assignments have been made by the sales department of Tube Turns, Louisville, Ky., a division of National Cylinder Gas Co., Chicago. *Earl R. Muir, Jr.*, formerly district manager at Seattle, has been transferred to Louisville. He will supervise the newly-formed central district, comprising Kentucky, southern Ohio, Indiana and Illinois. *Richard T. Burke*, formerly located in Houston, has been appointed district manager at Seattle, succeeding Mr. Muir. *Vernon Shallcross*, member of the Tulsa office staff, has been transferred to the Denver territory. *W. C. Robinson*, formerly assistant sales manager of the eastern division, has been assigned to special promotional programs. He will be located at the Pittsburgh office.

Died . . .

W. R. Boyd of Boyd Welding Co., Erie, Pa., died recently. He was an active member of the National Welding Supply Association, Philadelphia, serving as vice-president (1947-48) and member of the board of directors (1945-51).

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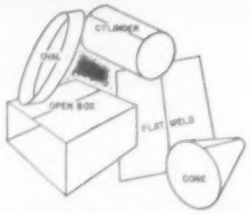

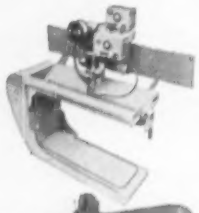

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Oxyacetylene welding

OXYACETYLENE WELDING. 4th edition. By Morgan H. Potter. Published by American Technical Society, Chicago, 1956. Hard cloth binding, 8½ by 5½ in., 140 pages. Price $2.50.

Newly revised edition is intended as a manual and practical text on oxyacetylene welding, hardfacing, lead burning and cutting. As the contents are based on actual shop practice, it should prove of value to the apprentice as well as the practicing weldor. The author is a former instructor of welding at the William Hood Dunwoody Industrial Institute.

Wide in scope, the book presents process and theory briefly. The balance of the text is devoted to the practical techniques of welding steel, cast iron, malleable iron, bronze, copper, aluminum and white metal. A section treats design of jigs. Silver soldering, hardfacing, cutting and lead burning are discussed in detail. In addition, a new section has been added on safe welding practices. The book is amply illustrated, with examples drawn from many industries.

It is suitable for home-study or classroom use.

Metalworking

METALS HANDBOOK, 1955 SUPPLEMENT. Published by the American Society for Metals, Cleveland, 1955. 208 pages. Price $6.

The aim of this supplement to the *Metals Handbook*, of the American Society for Metals, is to provide practical information on a wide variety of metalworking subjects requiring up-to-date reference material. There are 21 articles, written by 19 technical committees of the Society.

The supplement is divided into four main sections treating metals and applications, design and application, processing and fabrication, and testing and inspection. Among subjects covered are selection of electrodes for manual arc welding of low carbon steel, induction hardening, flame hardening, radiography of metals.

The book is plentifully supplied with tables, graphs and illustrations, including, in many cases, cost analyses. An 8-page index is appended.

30 YEARS AGO

(Taken from *The Welding Engineer* of April, 1926)

Stulz-Sickles Co., Newark, N. J. has appointed the following West Coast agents: P. L. Casford, San Francisco and W. L. Colcord, Los Angeles.

— 30 YEARS AGO —

A newcomer in the welding field, Electric Welder Controller Co., Pittsburgh, will devote its activities to electric welding. S. W. Mann is president of the firm.

— 30 YEARS AGO —

Charles L. Gulick has been appointed exclusive sales agent for the cylinder department of Wm. Wharton Jr. & Co., Inc. Mr. Gulick was manager of cylinder sales for the firm for seven years.

— 30 YEARS AGO —

U. S. Welding Co., Minneapolis, and Harris Calorific Co., Cleveland, have merged. U. S. Welding will function as a division of Harris Calorific. George B. Harris is the new president and Lorn Campbell, Jr., has been named vice-president and general manager.

— 30 YEARS AGO —

Collier's recently published an item about Mrs. Catherine Nelson of Jersey City, N. J., stating that she averages $30 per day as an electric arc weldor.

— 30 YEARS AGO —

L. F. Loutrel, vice-president and general manager of Shawinigan Products Co., and R. A. Witherspoon, vice-president and general manager of Canada Carbide Co., have just completed a visit to Shawinigan plants in Iowa and Alabama.

— 30 YEARS AGO —

J. E. Styrmoe has accepted a position with Central Steel & Wire Co., Chicago. Mr. Styrmoe has been connected with the service department of Westinghouse Electric Mfg. Co.

— 30 YEARS AGO —

Howard Russell, vice-president of Spokane Oxyacetylene Co., Spokane, Wash., was a recent visitor in Chicago.

— 30 YEARS AGO —

Charles Kandel has been appointed sales manager of International Oxygen Co.

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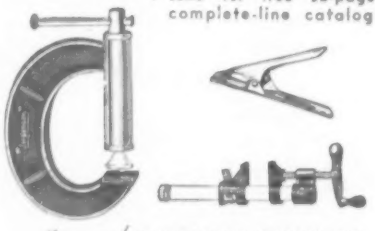

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52. INDUCTION HEATER — Scientific Electric. 4-page illustrated folder treats "hf" induction heaters for variety of applications.

53. SAFETY GOGGLE—Wilkie Optical, Inc. Bulletin 20A illustrates and describes "Softsides" all-purpose plastic goggle.

54. CONNECTORS, CLAMPS—Albert & J. M. Anderson Mfg. Co. Catalog 49C discusses, with illustrations, "Eitherend" connectors and models of welding clamps.

55. CLEANING COMPOUND — Oakite Products, Inc. Folder (F.9582R) describes metal cleaning with "Rustripper" cleaning compound.

56. WELDING CAST IRON—The International Nickel Co., Inc. 4-page booklet "The repair of cast iron parts" outlines latest information on welding of cast iron, with nine graphic case histories.

57. AUTOMATIC WELDER — Graham Mfg. Corp. Illustrated sheet discusses Model X-8000 automatic bench welder for stud welding.

58. FUME EXHAUSTER—Chicago Blower Corp. Bulletin SPE-103 describes "Chicago" steel plate exhausters designed for removing gases, hot air, industrial dust.

59. WELDING WIRE—H. K. Porter Co., Inc. Technical Bulletin T-2 presents details on available shapes, sizes and materials of shaped wire, with emphasis on welding.

60. AUTOMATIC VALVES—Rivett Lathe & Grinder, Inc. 8-page catalog No. 261 describes hydraulic valves, solenoid-controlled and panel mounted.

61. CARBIDE FINISHING—Adamas Carbide Corp. 4-page booklet "What size nose radius?" is aid to selection of nose radii; discusses relationship between nose radius and carbide tool wear.

62. HOSE COUPLINGS—Titeflex, Inc. 20-page illustrated catalog (Form 7-55-20) discusses "Quick-Seal" connect-disconnect hose couplings, including graphs, specifications, coupling accessories.

63. BRAZING FLUX—American Platinum Works. "A complete guide to selective fluxing for low temperature silver brazing" is a pocket-size booklet.

64. RADIOGRAPHY—High Voltage Engineering Corp. Bulletin R describes new approach to high voltage radiography with "Van de Graaff" X-ray generators.

65. HARDFACING — Coast Metals, Inc. Booklet describes hardfacing process listing physical properties and typical uses of available alloys.

66. WELDING STEEL—The Babcock & Wilcox Co. Bulletin TDC-162A discusses welding stainless steel using various techniques, including electrode selection.

67. HEAT TREATING—Selas Corp. of America. "High Gradient" (No. 22) describes heat and fluid processing problems with latest developments.

68. WELDING CABLE — General Cable Corp. Folder discusses, with illustrations, types of welding cables, giving construction and use.

69. WELDOR'S GOGGLES—American Industrial Safety Equipment Co. Illustrated sheet discusses No. 1440 plastic goggles.

70. ACETYLENE TORCH—Velocity-Power Tool Co. 4-page illustrated folder (No. 1413-3) treats "Century Torch-o-matic" air-acetylene gun.

71. HARDFACING WELDING WIRE—Drawalloy Corp. 4-page leaflet describes and illustrates "Wear-O-Matic" hardfacing wire for automatic and semi-automatic use.

72. CUTTING TORCH — Smith Welding Equipment Corp. Pocket-size folder (Form No. 245) describes "Silver Star" cutting torches using oxygen and acetylene.

73. CO_2 MIG WELDING—Air Reduction Sales Co. 12-page booklet "Carbon-Dioxide-Shielded Consumable-Electrode Arc Welding" is reprint of article from *Welding Journal.*

74. ELECTRODE—Mir-O-Col Alloy Co., Inc. Descriptive sheet discusses the composition and uses of "Tungmetal" tungsten electrode.

75. PORTABLE WELDER—The Lincoln Electric Co. 4-page illustrated folder describes the "Lincwelder 100" portable welder for number of uses.

76. SOLDERS—Anchor Metal Co., Inc. Bulletin lists and describes applications of new solder alloys for cast iron, aluminum, stainless steel.

77. MIG WELDING—A. O. Smith Inc. Bulletin WM-175 discusses "C-Omatic" automatic welding process using carbon dioxide.

78. RW WELDER—Sciaky Bros., Inc. Bulletin 316-7 describes the "Type MP 1" air-operated, press-type, single-phase seam welder for wide range of applications.

79. ALUMINUM — Kaiser Aluminum & Chemical Corp. 24-page booklet (GI-15-56) gives data on aluminum alloys—properties, applications, with special attention to welding.

80. WELDING WIRE — The Reid-Avery Co., Inc. Leaflet describes "Raco" welding wire for inert-gas-shielded arc welding.

81. ELECTRODE — Ampco Metal, Inc. Sheet illustrates and gives uses of "Ampco-Braz No. 1" nickel-brass brazing rod for joining and overlay with oxyacetylene process.

82. AUTOMATIC WELDER — Niagara Machine & Tool Works. Bulletin 83-A treats automatic welder for welding variety of sizes and shapes of weldments.

83. GRINDING WHEELS—Bay State Abrasive Products Co. 4-page brochure (Form 11) explains composition and uses of cut-off and grinding wheels.

84. BLAST CLEANING—Wheelabrator Corp. Catalog No. 724 gives 56 production cleaning problems using airless blast equipment; welding problems get special mention.

85. AUTOMATIC WELDING ELECTRODES—The Reid-Avery Co., Inc. 4-page folder "Lightly coated high speed automatic welding electrodes" illustrates and describes such electrodes.

86. HIGH VOLTAGE TESTER—Associated Research, Inc. Bulletin 5B describes line of high voltage a-c test sets, including series for mobile use.

87. STEEL TUBING—The Babcock & Wilcox Co. Bulletin TB-408 is listing of tubing available, with brief description of technical literature on specific types as stainless pipe, heat exchanger and condenser tubing.

88. SAFETY CLOTHING—Johns-Manville. "Asbestos safety clothing" is 12-page booklet describing various types of safety apparel, including asbestos suits, helmets, gloves.

89. WELDER—Graham Mfg. Corp. Bulletin 4000 gives specifications on "Model 4000" air portable welder.

90. ELECTRODE—Crucible Steel Co. of America. 15-page data sheet (DS 164) treats "Rezistal" stainless-steel electrodes for a-c and d-c welding.

91. GRINDING, FINISHING—Adamas Carbide Corp. "Adamas Tungsten Carbide Grades," is 4-page folder describing line of tungsten carbide grades for machining cast iron, steel cutting, etc.

92. PORTABLE AIR TOOLS—Rotor Tool Co. 8-page bulletin No. 53 gives specifications for drills, grinders, scalers, chippers.

93. WELDER—Kasson Die & Motor Corp. Illustrated 4-page folder describes the 200-amp, 50% duty cycle arc welder "Model 200 AW."

94. CABLES—Pyle-National Co. Bulletin 1252-H discusses all-weather submersible cable connectors, plugs, receptacles for power, control circuits.

95. WELDING HELMETS—Metro Mfg. Co. Illustrated sheet describes models of welding helmets.

96. ELECTRIC TESTING—Multi-Amp Corp. Bulletin 555 describes types of portable high-current test instruments, including those for protective equipment, production units.

97. GRINDING WHEELS—Norton Co. 4-page leaflet describes salvaging swarf from diamond wheel grinding operations.

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Also information about

NEW PRODUCTS described on pages 70 to 80

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146. Page Steel & Wire Div.—Folder DH-402 sets forth analyses of automatic welding wire.

147. Pandjiris Weldment Co.—Catalog 8155 on welding head manipulators, positioners (weld evators), flame-cutting turntable for multi-bevel cuts on edge of cylindrical shapes, seamers and turning rolls.

148. Reid-Avery Co., Inc.—Information on "120-16T" electrodes for welding T-1 steel plate and "Pay-Off-Pak" for automatic submerged arc welding and inert gas welding.

149. Ross Operating Valve Co.—Complete information on the "Comet II," an advanced conception of valving on a direct-solenoid operated, balanced spool 4-way for air or oil service.

150. A. O. Smith Corp.—Details on "SW-65" (E 6016 and MIL 7016 low hydrogen) electrodes for high carbon steels and steel of poor weldability.

151. Stoody Co.—"The Stoody Guidebook," on hardfacing in the brick and clay industry.

152. Stulz-Sickles Co.—Details on manganese-nickel steel weld deposits.

153. Tempil Corp.—Information on, and sample pellets of, temperature indicators.

154. Tweco Products Co.—Catalog on complete line of arc-welding accessories and aluminum arc-welding cable.

155. Vernon Tool Co., Ltd.—Literature and Bulletin FC-8 on flame-cutting welding fittings.

156. Vickers Electric Div.—Complete information and literature on "Controlarc" d-c welder and low spatter performance on special electrodes.

157. Victor Equip. Co.—Manual and descriptive leaflets on coated high-alloy and other welding rods.

158. Wagner Mfg. Co., Inc.—Descriptive literature on "Hi-Amp" electrode holders.

159. Weldit, Inc.—Complete information on welding torches.

160. Westinghouse Electric Corp.—Information and samples on "XL-610," the soft-arc, easy-handling AWS E-6010 electrode.

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102. Air Reduction Sales Co.—Catalog 9-13WE on rods and fluxes for joining ferrous and non-ferrous metals and literature describing Tig equipment and electrodes.
103. Air Reduction Sales Co.—Catalog 1318-WE, "Airco Electrode Guide," helps you select right electrode for your specific job.
104. Alloy Rods Co.—Complete information on "Atom Arc 7016" iron powder, low-hydrogen electrodes.
105. All-State Welding Alloys Co., Inc.—Pocket reference on joining aluminum and aluminum alloys.
106. Ampco Metal, Inc.—Bulletin on resistance-welding electrodes and accessories.
107. Amperex Electronic Corp.—Data sheets and name of nearest distributor for ignitrons used in heavy-duty, three-phase welding rectifier and thermostatically controlled ignitrons.
108. Arcair Co.—Complete details on money-saving way to remove defects in welds and castings; case history book on advantages of arc-cutting and gouging torch.
109. Arcos Corp.—Information on stainless coiled wire and stainless electrodes.
110. Becker Bros. Carbon Co.—Information on carbon welder brushes for all makes of welding equipment.
111. Brennen, Bucci & Weber, Inc.—Brochure gives complete specifications on the "SP-100" spot welder.
112. Buck Mfg. Co.—Write for dealer's name and descriptive literature on "Bux" weldor's magnetic plate clamps.
113. Champion Rivet Co.—Information on "Speedemon" iron powder electrodes.
114. Columbia Electric Mfg. Co.—Catalog WE-400 on the "Tong Test" a-c/d-c ammeter.
115. Contour Marker Corp.—Information and instruction book on laying out pipe joints.
116. Drawalloy Corp.—Information on finish, temper, diameter tolerance and chemical analysis of welding wire.
117. Eisler Engineering Co., Inc.—Data on spot welders and general welding equipment.
118. Erico Products, Inc.—"Caddy Catalog" on test installation.
119. Eutectic Welding Alloys Corp.—"Eutectic Weldor Magazine," with case histories of time and money savings on maintenance and repair.
120. Foote Mineral Co.—Catalog, "Foote Raw Materials for Welding Rod Coatings."
121. General Electric Co.—Bulletin GEC-1305 on 295-amp a-c welders and Bulletin GEA-6242 on rectifier welders.
122. General Electric Co.—Bulletin GEA-6243 on a-c welders and electrode catalog GED-2584.
123. General Electric Co.—Bulletin GEC-644 on m-g welders and Bulletin GEC-1333 on 200-amp engine-drive welder.
124. Glenn Co.—Literature, application data, prices on constant-voltage welders.
125. Harnischfeger Corp.—Information on constant-voltage welders.
126. Harrisburg Steel Corp.—Literature and prices on unusual life expectancy of seamless-steel, high-pressure gas cylinders.
127. Harris Calorific Co.—Folder 540710 on "Super-Heat" torch that uses oxygen and fuel gases (propane, city gas, etc.).
128. Helmco, Inc.—Literature on flux pots for warming and maintaining brazing flux at constant temperature.
129. Hobart Bros. Co.—Details on a-c power/d-c welder combination and a-c and d-c welders.
130. Hobart Bros. Co.—Information on "Powr-o-matic" (constant voltage) simplified automatic welding.
131. Holger Andreasen, Inc.—Information on "Andrex" portable X-ray for fast, thorough and economical non-destructive inspection of welded metal structures.
132. International Nickel Co., Inc.—"Welding Bulletin T-2," on "130 Monel" electrodes.
133. International Nickel Co., Inc.—Folder, "Announcing Inco-Rod A," on proven combinations of dissimilar alloys.
134. K-G Equipment Co., Inc.—24-page catalog on single-stage regulators.
135. Kaiser Aluminum & Chemical Corp.—Informative folder, "New Advantages in Arc Welding with Aluminum Welding Cable."
136. Lincoln Electric Co.—Specifications and procedures in Weldirectory SB-1351 on "Fleetweld 47," a-c or d-c iron-powder electrode for mild steel.
137. Linde Air Products Co.—Manual on mechanized Tig and Mig welding torches.
138. Liquid Carbonic Corp.—Catalogs on complete lines of gas and arc welding equipment and literature on improved CO_2 Tig and Mags methods of welding.
139. Mallory & Co., Inc., P. R.—Full facts on welding electrodes, holders, seam welding wheels, dies and accessories to meet standard or special requirements.
140. Metal & Thermit Corp.—Information on "Murex" electrodes, machines and accessories.
141. Metal Bond Mfg. Co.—Catalog on soldering and welding products.
142. National Carbide Co.—Write for name and address of nearest supplier.
143. National Welding Equip. Co.—Illustrated brochure on oxygen and acetylene equipment and accessories.
144. Norris-Thermador Corp.—Specifications on all sizes of acetylene cylinders.
145. Norton Co.—Details on the new "B-11" resinoid bonded wheels for weld grinding.

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